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29th Annual Session

AMERICAN CONGRESS OF PHYSICAL MEDICINE

September 4, 5, 6, 7, 8, 1951

SHIRLEY-SAVOY HOTEL DENVER, COLORADO

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29th Annual

Scientific and Clinical Session

and

Instruction Seminar

September 4, 5, 6, 7 and 8, 1951

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EDITOR OF THE MONTH

WALTER M. SOLOMON, M.D.
Cleveland, Ohio

Printed in U.S.A.

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Council on Medical Education and Hospitals of the American Medical Association

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		5 yrs.	FebSept	High sch.	$450	Cert.&B.S.	
Mills College, Oakland, Calif.	Mills College	3 yrs.	FebSept	Degree	$200	Certificate	----
					$550		
San Jose State College, San Jose, Calif.	San Jose State College	1½ yrs.	Varies	Degree	$ 21	Certificate	10
		3¼ yrs.	Varies	High sch.	$ 21	Degree	
University of Illinois College of Medicine, 1853 W. Polk St., Chicago	University of Illinois	5 yrs.	Feb	High sch.	$152	B.S.	14
University of Iowa, Iowa City, Iowa	State University of Iowa, College of Medicine	5 yrs.	.....	High sch.	$ 85	Cert.&Deg	
University of Kansas, Lawrence	University of Kansas	2 yrs.	FebSept	Degree	$131	Certificate	10
		4 yrs.	FebSept	High sch.	$131	B.S.	
Boston School of Occupational Therapy, 7 Harcourt St., Boston	Tufts College	2 yrs.	Sept	Degree	$500	Diploma	13
		5 yrs.	Sept	High sch.	$450	B.S.	
Wayne University, 4841 Cass, Detroit, Mich.	Wayne University, College of Med., Coll. of Liberal Arts, Coll. of Education	5 yrs.	.....	High sch.	.....	.....	
Kalamazoo School of Occupational Therapy, Western Michigan College of Education, Kalamazoo	Western Michigan College of Education	1½ yrs.	FebSept	Degree	$127	Diploma	20
		4 yrs.	FebSept	1 yr. coll.	$127	Degree	
Michigan State Normal College, Ypsilanti	University of Michigan	5 yrs.	Varies	High sch.	$118	Cert.&Deg.	8
University of Minnesota, Church Street, Minneapolis	University of Minnesota	4 yrs.	.....	High sch.	$360	B.S.	
College of St. Catherine, St. Paul, Minn.	The College of St. Catherine	3½ yrs.	Varies	1 yr. coll.	$210	Degree	4
Washington University School of Medicine, St. Louis	Washington University	3 yrs.	Sept	2 yrs. coll.	$400	Degree	10
University of New Hampshire, Durham	Univ. of New Hampshire	5 yrs.	Sept	High sch.	$160	Cert.&Deg.	6
Columbia University College of Physicians and Surgeons, 630 W. 168th St., New York City	Columbia University	1½ yrs.	Sept	Degree	$450	Certificate	28
		2½ yrs.	Sept	2 yrs. coll.	$450	Degree	
New York University School of Education, 100 Washington Sq. E., New York City	New York University	4½ yrs.	FebSept	High sch.	$500	Cert.&Deg.	20
Ohio State University, Columbus	Ohio State University	3 yrs.	Quarterly	High sch.	$105	Degree	21
Philadelphia School of Occupational Therapy, 419 S. 19th St., Philadelphia	University of Pennsylvania	1½ yrs.	Sept	Degree	$500	Diploma	35
		3 yrs.	.....	1 yr. coll.	$500	Diploma	
		.....	.....	High sch.	$600	.....	
Texas State College for Women, Denton, Tex.	Texas State College for Women	5 yrs.	FebSept	High sch.	$150	Degree	13
Richmond Professional Institute, 901 W. Franklin St., Richmond, Va.	Medical College of Virginia	1½ yrs.	Sept	Degree	$200	Certificate	20
		3 yrs.	Sept	1 yr. coll.	$200	Certificate	
College of Puget Sound, Tacoma, Wash.	College of Puget Sound	3 yrs.	FebSept	Degree	$350	Certificate	
		5 yrs.	FebSept	High sch.	$300	Cert.&Deg.	
University of Wisconsin, Madison	University of Wisconsin	4 yrs.	FebSept	High sch.	$320	Cert.&Deg.	8
Milwaukee-Downer College, Dept. of Occupational Therapy, 2512 E. Hartford, Milwaukee	Milwaukee-Downer College	2½ yrs.	Sept	1 yr. coll.	$300	Diploma	22
		4 yrs.	Sept	High sch.	$300	Dipl.&Deg.	
Mount Mary College, 2900 Menomonee River Dr., Milwaukee		Varies	Sept	Degree	$335	Certificate	15
University of Toronto, Dept. of University Extension, Toronto, Ont., Canada	University of Toronto	5 yrs.	Sept	High sch.	$260	B.S.Deg.	
		3 yrs.	Sept	1 yr. coll.	$222	Diploma	110
Colorado Agricultural and Mechanical College, Fort Collins, Colorado		5 yrs.	Sept	High sch.	.....	B.S.	

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College of Medical Evangelists, Los Angeles[1]	Fred B. Moor, M.D. R. William Berdan	a-b-c	15 mos.	Sept	16	$300	Cert. or Dipl.
University of Southern California, Los Angeles[1, 3]	Charles L. Lowman, M.D.	a-b-e	14 mos.	Sept	20	$662	Certificate
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University of Colorado Medical Center, Denver[1]	Harold Dinken, M.D. Miss Mary Lawrence	a-b-d	12 mos.	Sept	12	$300[3]	Cert. or Degree
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State University of Iowa Medical School, Iowa City[1]	W. D. Paul, M.D. Mrs. Olive Farr	e	12 mos.	Sept	15	$200	Certificate
University of Kansas School of Medicine, Kansas City[1]	Donald L. Rose, M.D. Mrs. Ruth G. Monteith	a-b-d	12 mos.	FebSept	15	$ 80[3]	Cert. or Degree
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Hermann Hospital, Houston[1]	Miss Ruby Decker Oscar O. Selke, Jr., M.D. Mary Elizabeth Kolb	a-b-d	12 mos.	Oct	12	$300	Cert. or Degree
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University of Wisconsin Medical School, Madison	Harry Bouman, M.D. Miss Margaret A. Kohli	a-b-c H.S.	12 mos. 4 yrs.	FebSept Sept	20 20	$120[3]yr $120[3]yr	Certificate Cert. & Degree
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Cleveland Clinic Hospital, Cleveland, Ohio	Shelby G. Gamble, M.D. Miss Mildred Heap	a-b-d	12 mos.	Oct.	12	$200	Diploma

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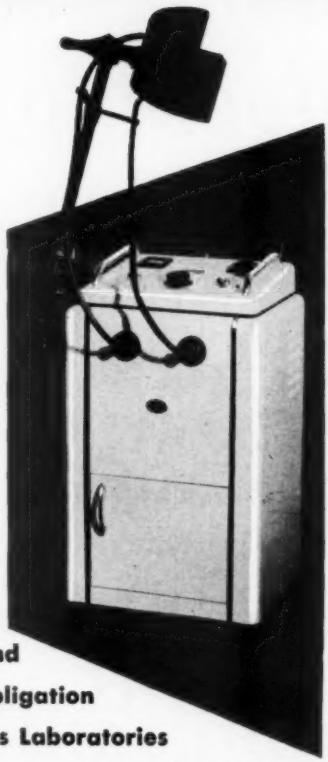

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AN EXPERIMENTAL STUDY OF THE EFFECTS OF ULTRASONIC ENERGY ON THE LOWER PART OF THE SPINAL CORD AND PERIPHERAL NERVES *

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With the increasing interest in the therapeutic applications of high frequency sound vibrations (ultrasonics) the question has arisen, "What are the effects of ultrasonic energy on the nervous system?" This question has become pertinent for two reasons: 1. The greatest claims for therapeutic applications of ultrasonic energy have been made for disorders, such as sciatica and lumbago, which involve the nervous system. 2. Paralysis was observed in laboratory animals after single applications of ultrasonic energy to the midline of the back. The recommended application of ultrasonic energy to the back in cases of lumbago and sciatica is made in practically the same manner as in laboratory animals in which paralysis resulted. Therefore, it was deemed important that before the therapeutic applications of ultrasonic energy are considered further the effects on the nervous system should be investigated. The present work is a beginning of this study in which only two aspects have been approached: (1) the effects of ultrasonic energy on the lower part of the spinal cord and (2) the effects on peripheral nerves. In both aspects the observed effects were limited to (1) changes in function as evidenced by clinical observation of paralysis and by alteration of action potentials of nerve, (2) temperatures produced in tissues by ultrasonic energy and (3) histopathological changes in nerve tissue resulting from ultrasonics. The effects of direct heating on peripheral nerves also were studied and compared with the effects of ultrasonic energy.

Generally, only maximal doses of ultrasonic energy were used in this study. As in most initial investigations of new physical agents for treatment, it was considered important to learn first the effects of maximal doses of ultrasonic energy on the nervous system. After these have been determined, the effects of smaller doses can be observed in subsequent studies.

Review of Literature

In the first report[1] of biologic effects of exposure of frogs and fish to high frequency sound waves of great intensity, made in 1927, the outstanding

* Read at the Twenty-Eighth Annual Session of the American Congress of Physical Medicine, Boston, Aug. 31, 1950.
* Abridgment of a thesis submitted by Dr. Anderson to the Faculty of the Graduate School of the University of Minnesota in partial fulfilment of the requirements for the degree of Master of Science in Physical Medicine.
1. Wood, R. W., and Loomis, A. L.: The Physical and Biological Effects of High Frequency Sound Waves of Great Intensity, Philosophic Mag. 4:417 (Sept.) 1927.

effects mentioned were crippling and laming. Neurological disorders were included in the first report of successful therapeutic applications of ultrasonic energy to man.[2] The patients treated for sciatica were said to exhibit the most dramatic and rapid improvement. The characteristics of the therapeutic dose of ultrasonic energy determined by this group are generally the same as those used in current ultrasonic therapy. A frequency of 800,000 cycles per second was chosen as optimal; that is, sufficiently high not to be painful and yet low enough to have good penetration. At this frequency 50 per cent of the energy is absorbed in 4.9 cm. of tissue. This depth of penetration was considered adequate to affect deep-lying structures, such as the sciatic nerve.

Scholtz[3] confirmed the work of Pohlman, Richter and Parow on the successful ultrasonic treatment of sciatica.

After 1947 great numbers of reports appeared in European medical literature claiming excellent results from ultrasonic energy in a large variety of diseases and disorders. It was indicated that the best results were obtained in sciatica and lumbago.[4]

The manner in which the supposedly beneficial effects of ultrasonic treatment are achieved has not been determined for any of these conditions. Some investigators have considered that ultrasonic vibrations perform a micromassage. Many have spoken of the "analgesic effect" of ultrasonic energy but do not make it clear whether this is a unique effect of ultrasonic energy on nerve tissue or whether it can be ascribed to a secondary heating effect. Nerve tissue is thought to be affected more than muscle, fascia and other surrounding tissues, not only because of its high lipid content[5] but also because of its physical relationship to other tissues — that is, at fascial planes between muscles. Dittmar has postulated that an irritative effect is produced by ultrasonic energy on superficial nerve fibers in the skin and on the nerve fibers in the blood vessels acting in such a way that moderate ultrasonic doses cause local vasodilatation and more intense doses cause vasoconstriction.

Many investigators in this field wonder whether the therapeutic effects of ultrasonic energy are not due entirely to the heat resulting from the absorption of ultrasonic energy by the tissues. Pohlman[6] asserted that standing waves are avoided by moving the ultrasonic head back and forth in a massaging manner and that thereby the heating effect is spread out over a large area. In this manner the heating effect becomes insignificant he stated, because the circulation is easily capable of removing the heat. However, it may be that momentary point heating is an essential factor in producing certain of the beneficial effects of ultrasonic treatment. The idea was emphasized by Schmitz[7] who stated that if this is the case the measurement of heat produced by ultrasonic energy would be difficult for the biophysicist. He left it to the biologist to decide whether the mechanical or the thermal effects are dominant in ultrasonic therapy.

Lehmann[8] concluded that the effects of ultrasonic energy on sciatic nerves of the mouse were dependent on temperature. Woeber[9] concluded that they

2. Pohlman, R.; Richter, R., and Parow, E.: Über die Ausbreitung und Absorption des Ultraschalls im menschlichen Gewebe und seine therapeutische Wirkung an Ischias und Plexusneuralgie, Deutsche med. Wchnschr. 65:251 (Feb.) 1939.
3. Scholtz, H. G.: Ultraschall zur Behandlung von Emphysem und Asthma, Deutsche med. Wchnschr. 68:880 (Sept.) 1942.
4. Matthes, K., and Rech, W.: Der Ultraschall in der Medizin, Zurich, S. Hirzel, 1949.
5. Dittmar, C.: Über die Wirkung von Ultraschallwellung auf tierische Tumoren, Strahlentherapie 78:217 (Nov.) 1948.
6. Pohlman, R.: Die Ultraschalltherapie: Quantitative Angaben zu ihrem Wirkungsmechanismus, Deutsche med. Wchnschr. 73:373 (Sept.) 1948.
7. Schmitz, W.: Die Ultraschallforschung in ihrer Bedeutung für Biologie und Heilkunde: Physikalische Grundlagen der Ultraschallforschung, Strahlentherapie 79:490 (July) 1949.
8. Lehmann, J.: Über die Temperaturabhängigkeit therapeutischer Ultraschallreaktionen unter besonderer Berücksichtigung der Wirkung auf Nerven, Strahlentherapie 79:543 (July) 1949.
9. Woeber, K.: Über das Auftreten von Schädigungen am Zentralnervensystem der Ratte durch Ultraschallwellen, Strahlentherapie 79:643 (July) 1949.

were independent of the change in temperature, whereas the temperature effects are an accompanying complication which can be eliminated by use of the interrupted method or moving technic of application. Histopathological studies on the spinal cords of the rats paralyzed in Woeber's investigations were made by Peters.[10] He found in the spinal cord degenerative changes that were typical of any type of trauma and were in no way pathognomonic of ultrasonic damage.

The question arises, "What are the effects of plain direct heat on various structures of the nervous system?" Many reports have been made on the effects of heat on peripheral nerves of cold-blooded animals, such as the frog and the squid. Nerves of the frog fail to respond to electrical stimuli at 48 C.[11] Other authors[12] have shown that there is a critical temperature for the sciatic nerve (varying with each species) at which thermal paralysis develops as evidenced by decreased action potentials. The failure to find reports on similar studies on the effects of heat on mammalian nerve prevented the making of a comparison of the effects of heat with the effects of ultrasonic energy on mammalian nerve.

Methods and Material

Laboratory Animals. — The laboratory animals used were the albino rat and the dog. Applications of ultrasonic energy were made only when the animal was properly anesthetized, the dog by pentobarbital sodium or pentothal sodium given intravenously and the rat by pentobarbital sodium given intraperitoneally. Curare was given intravenously to some of the dogs to block the myoneural junctions when recordings of action potentials of nerves were made.

Rats were used only for studies of the spinal cord, whereas dogs were used for studies on both the spinal cord and peripheral nerves. The principal peripheral nerve studied was the sciatic. Six intact dogs were used for the study of the effect 24 hours or more after application of ultrasonic energy to the sciatic nerve. In this group, action potentials were not studied prior to the application of ultrasonic energy.

Applications of Ultrasonic Energy. — The ultrasonic generator used was the Sieman's sonostat, which generates sound vibrations at a frequency of 800,000 cycles per second. The quartz crystal is mounted in a metal case and is connected to the oscillating circuit by a coaxial cable. No electromagnetic radiation could be detected.

The coupling medium used was water which had been degassed by boiling and then allowed to cool to room temperature. The water was placed in a lucite cylinder over the shaved skin of the area to which ultrasonic energy was to be applied. The sound head was placed in the open end of the lucite applicator. The distance the sound energy traveled through the water from the sound head to the skin was 3.5 cm. All surfaces coming into contact with the water were previously coated with a detergent, aerosol, to reduce the surface tension and minimize the formation of bubbles in the coupling medium.

The stationary technic was used for all applications. This policy was in keeping with the desire to determine the effects of maximal doses. Theoretically, ultrasonic energy has a greater effect on tissues when it is applied in one fixed place than when it is applied over a larger area by moving the applicator back and forth. Otherwise, the applications of ultrasonic energy were made in the manner recommended for clinical use. The areas receiving applications of ultrasonic energy in this study were the following: (1) the entire lumbar areas of the rats, (2) the region over the first and second lumbar vertebrae of the dogs and (3) the midthigh region of the dogs over the course of the sciatic nerve.

The Elicitation of Action Potentials. — Action potentials of the sciatic nerve were elicited by applying an electrical stimulus directly to the proximal portion of the intact sciatic nerve and picking up the transmitted impulse in the distal portion of the nerve. The action potential was amplified and presented on the cathode-ray oscilloscope for visual observation and recording by camera.

10. Peters, G.: Die Wirkung der Ultraschallwellen auf das Zentralnervensystem, Strahlentherapie 79:653 (July) 1949.
11. Boycott, A. E.: On the Influence of Temperature on the Conductivity of Nerve, J. Physiol. 27: 488 (Jan.) 1902.
12. Bremer, F., and Titeca, J.: Étude oscillographique de la paralysie thermique du nerf, Arch. internat. de physiol. 54:237, 1946.

For production of the stimulus the electrodyne stimulator was used. The duration of the stimulus, was less than 0.1 millisecond. These stimuli were applied at a frequency of 50 per second.

The prolongation of anesthesia, the presence of the electrodes around the nerve and other factors per se caused a slow, gradual, slight decrease in the amplitude of the action potential. This decrease was not appreciable over a period of two to four hours and, therefore, did not affect the experiments with ultrasonic energy and heat, none of which lasted more than one hour. However, this gradual decrease in the amplitude of the action potential made it not feasible to observe continuously the prolonged effects (twenty-four to seventy-two hours) of ultrasonic energy. Instead, action potentials were elicited for sciatic nerves to which ultrasonic energy had been applied 24 hours or more previously, and the action potential of the sciatic nerve of the opposite side was used as the control for comparison.

Under the conditions used, the configuration of the action potential as it appeared on the oscilloscope was complex (fig. 1 *a*). A less complex, biphasic pattern (fig. 1 *b*)

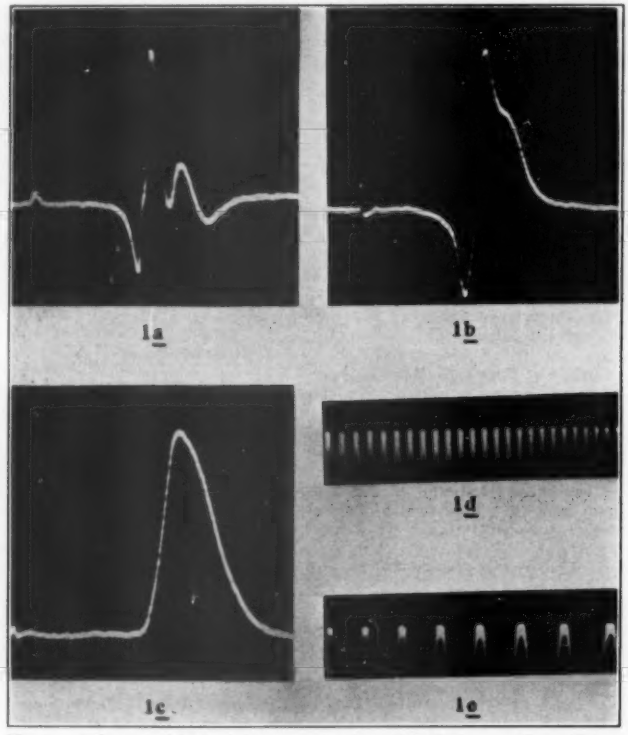

Fig. 1. — Action potential of sciatic nerve of a dog. 1(*a*) Bipolar recording. Pick-up electrodes 1 cm. apart, both on viable nerve 11.5 cm. distal to stimulating electrodes. Nerve in situ (that is, in volume conductor). 1(*b*) Monopolar recording. One pick-up electrode on viable nerve 11.5 cm. distal to stimulating electrodes. Second pick-up electrode on killed end of nerve. Nerve in situ (that is, in volume conductor). 1(*c*) Monopolar recording. Electrodes as in 1(*b*) but nerve suspended in air. 1(*d*) Time interval 0.0002 second for records 1(*a*) and 1(*b*). 1(*e*) Time interval 0.0009 second for record 1(*c*).

can be elicited by crushing the distal portion of the nerve. Lifting the nerve out into the air produces an even simpler monophasic pattern (fig. 1 *c*). This monophasic spike lends itself to analysis. However, in the present study, keeping the nerve in as near physiological conditions as possible was considered more important than analysis of the spike. Therefore, only the changes in vertical amplitude of the complex pattern

were considered. The patterns shown in figure 1 were not made under exactly the same conditions, but their use as examples is warranted.

Measurement of Temperature. — The temperatures of the tissues receiving an application of ultrasonic energy were measured by the thermistor, a type of resistance thermometer.[13]

For the measurement of heat produced by the application of ultrasonic energy over the spinal cord, a thermistor was introduced into the spinal canal, through a spinal puncture needle between two of the lower lumbar vertebrae. Aseptic conditions were maintained. The thermistor was pushed in until the bead reached the desired level in the spinal canal. The exact location was determined by roentgen rays in order that the center of the ultrasonic field could be directly over the tip. This procedure of passing a thermistor into and along the spinal canal had no deleterious effect on two control dogs which did not receive ultrasonic energy and which were observed for six weeks following this procedure.

Continuous recordings were made by a thermistor inserted into the rectum, in order to detect changes in general body temperature that might result from the application of ultrasonic energy over the spinal cord or the sciatic nerve.

For the measurement of heat produced by ultrasonic energy in tissues next to the sciatic nerve the thermistor was inserted after incision above the greater trochanter into the space between the intermuscular fascial planes where the sciatic nerve lies. Since there are no branches of the nerve nor any blood vessels of any appreciable size to or from the nerve along its anterior aspect in this region, the thermistor bead was easily passed in this fascial plane down along the anterior surface of the nerve to the midthigh. Applications of ultrasonic energy were so made that the center of the field was over the bead of the thermistor. The placing of the thermistor in the thigh in this manner did not alter the action potential of the nerve.

The presence of the thermistor bead in the ultrasonic field causes the registration of an unreliable temperature by the thermistor. This temperature reading is appreciably higher than the true temperature of the medium surrounding the bead. However, within less than 15 seconds after the application of ultrasonic energy is stopped, the thermistor registers valid temperatures. Therefore, only those temperatures were used which were registered 15 seconds after the ultrasonic generator had been turned off. It was thought that these cooling curves would afford a satisfactory indication of the approximate amount of heat produced in the tissues during the application of ultrasonic energy.

Direct Heating of the Nerve. — In order to compare the effects of direct heating with the effects of ultrasonic energy on the sciatic nerve, a small heating unit which could be fitted around the exposed nerve was constructed. To insure even heating, the surface in contact with the nerve was lined with silver. In the center of the silver plate was embedded an insulated thermistor bead with which the temperatures delivered to the nerve could be measured. The leads to the heating coils were connected to a Variac, by means of which the temperature of the silver plate could be regulated to within a fraction of a degree.

This unit was applied to the surgically exposed sciatic nerve in the region of the middle third of the thigh, the same point at which ultrasonic applications were made in other experiments. Fitting the unit around the nerve caused no change in the action potential.

Histologic Studies. — At the end of each experiment specimens of spinal cord or nerve, to which ultrasonic energy or heat had been applied, were removed and fixed in a 10 per cent solution of formalin. Hematoxylin and eosin stain, Weigert's myelin sheath stain (hereafter referred to as Weigert's stain) and the Gros modification of Bielschowsky's stain (hereafter referred to as Bielschowsky's stain) were made on sections from all specimens. In all experiments on the sciatic nerve except those with prolonged observations, specimens of nerve were obtained one to five hours after the application of the back at or below the level of the posterior iliac spine and curved to fit snugly ultrasonic energy or heat. In the prolonged observation experiments, specimens of supersonic energy.

Results of Studies on Spinal Cord

Clinically Observed Effects of Ultrasonic Energy on the Spinal Cord of the Rat. — In the rats receiving doses of less than 3.0 watt-minutes per square centimeter to the lumbar region paralysis did not occur, with one exception, whereas, with two exceptions, paralysis of the hindlegs and tail resulted from doses of more than 3.0 watt-minutes per square centimeter. Generally, the minimal dose which

13. Herrick, J. F., and Glarborg, E. A.: Application of Thermistors to Temperature Measurements in Experimental Investigations, Proc. Minnesota Acad. Sc., to be published.

resulted in paralysis was in the neighborhood of 3.0 watt-minutes; however, this finding was certainly not a consistent one. The dose relationship of intensity to duration could be varied inversely without changing the relative effectiveness of this minimal dose, which would produce paralysis, as long as the product of the intensity times the duration was 3.0 watt-minutes per square centimeter. However, there appeared to be a limit to the extent to which this dose relationship could be varied. When the intensity was reduced to 0.75 watt per square centimeter and the duration increased to four minutes, no paralysis occurred.

Whenever paralysis occurred, it became apparent immediately on recovery of the animal from the anesthetic in all except for two rats. The two rats used their legs until some time between the fourth and twentieth hours following recovery from anesthesia. No animal recovered from paralysis. Death, resulting from urinary stasis and infection, occurred in every instance within three to five days after onset of paralysis.

Clinically Observed Effects of Ultrasonic Energy on the Spinal Cord of the Dog. — Ultrasonic energy in doses of 5.0 watts per square centimeter applied for six to ten minutes over the upper lumbar vertebrae resulted in paralysis of the hindlegs and tail of five of seven dogs. This condition became apparent immediately on recovery of the dog from anesthesia. None of the dogs recovered from paralysis. Incoordination of gait developed in the hindlegs of one dog and was present for only four days. Ultrasonic energy had no apparent effect on the spinal cord of one dog, although it received a maximal dose of 5.0 watts per square centimeter for ten minutes.

Temperatures Produced by Ultrasonic Energy in the Spinal Canal of Dogs. — Cooling curves recorded by a thermistor located in the spinal canal at the level at which ultrasonic energy was applied were obtained on three of the seven dogs on which studies of the spinal cord were made. The temperatures recorded 15 seconds after application of ultrasonic energy was stopped were 42, 43 and 49 C., respectively. The temperature curves of the first two animals showed that cooling was slow, only 3 degrees in the first five minutes. The temperature of the third fell more rapidly, 6 degrees in the first five minutes. Paralysis resulted in all three. There were no changes in rectal temperatures during the application of ultrasonic energy and none following it.

Results of Studies on Sciatic Nerves

Immediate Effects of Ultrasonic Energy on the Action Potential. — The amplitude of the action potential of the sciatic nerve was reduced 50 per cent or more in 12 out of the 20 dogs to which ultrasonic energy was applied over the middle third of the thigh. In eight of these 12 dogs the action potential was reduced to zero (complete block) within ten minutes or less (fig. 2). Application of ultrasonic energy was stopped the instant the action potential became completely flattened. In the four dogs, in which the amplitude of the action potential was reduced 50 per cent or more from that of its control but was not reduced completely, applications of ultrasonic energy for fifteen minutes were given to three of these four dogs and for twenty minutes to the fourth. The action potential was unaltered in 40 per cent of the 20 dogs, even though maximal doses were given for ten to twenty minutes. These eight dogs received 66 per cent of the total 65 applications. These represented repeated unsuccessful attempts at affecting the sciatic nerve.

The percentage of applications which were effective in decreasing the action potential was greater when maximal doses were used than when less intense doses were given.

In the 22 applications in which ultrasonic energy affected the action potential, subsequent recovery depended on whether the action potential had been completely or partially decreased. In seven instances the action potential was only partially decreased. Subsequent recovery of the action potential of these seven

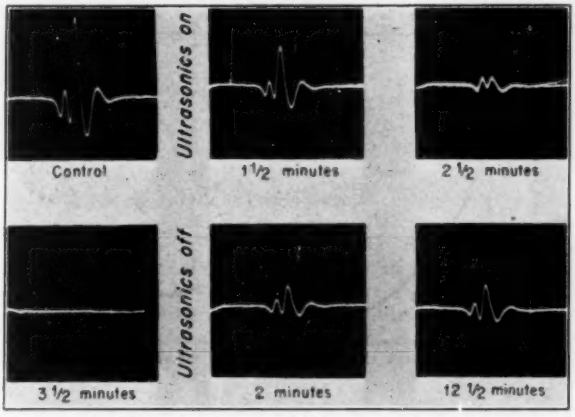

Fig. 2. — Effect of application of ultrasonic energy on action potential of sciatic nerve.

was complete in all but one. In 15 instances the action potential was completely flattened; in these recovery with one exception was not complete.

Effects of Direct Heating on the Action Potential. — The action potential of the sciatic nerve was decreased by direct heating in a manner strikingly

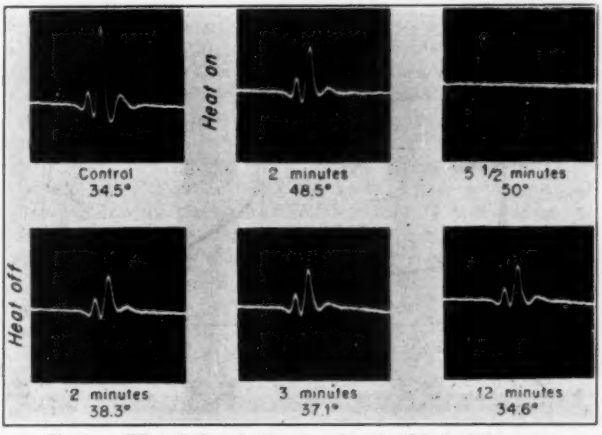

Fig. 3. — Effect of direct heating on action potential of sciatic nerve.

similar to that in which the action potential was decreased by ultrasonic energy. This effect on the nerve was consistent, and in none of the 12 applications of direct heat was there any instance in which the nerve was unaffected as in some of the applications of ultrasonic energy. The end point for heat was

the same as for ultrasonic energy — that is, that point at which flattening of the amplitude of the action potential had just become complete. After only three of the applications of direct heat was there complete recovery of the nerve. Figure 3 is an example of the other 9 applications following which recovery was not complete. The similarity between the response of the action potential

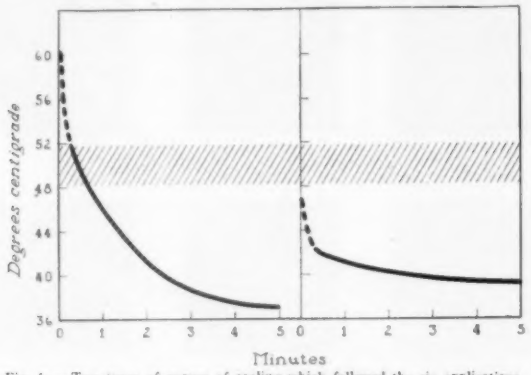

Fig. 4. — Two types of curves of cooling which followed the six applications of ultrasonic energy in which the action potential was decreased. The curve on the left is an example of the curves which followed three of the six applications, while the curve on the right is an example of the curves which followed the other three. The curves are superimposed on the graph showing the critical range of temperature for the sciatic nerve of the dog.

to heat (fig. 3) and to ultrasonic energy (fig. 2) is apparent. The records in figures 2 and 3 were made on the same dog; the left sciatic nerve received ultrasonic energy, and the right sciatic nerve, heat.

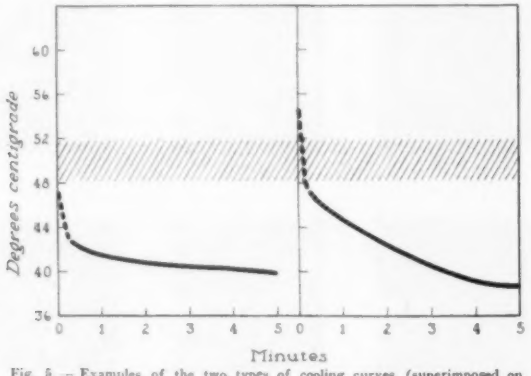

Fig. 5. — Examples of the two types of cooling curves (superimposed on the graph showing the critical range of temperature for the sciatic nerve of the dog) which followed the 10 applications of ultrasonic energy in which the action potential was not affected. The curve on the left is an example of six of these 10 applications, while the curve on the right is an example of the other four.

The range of temperature at which the action potential becomes decreased was found to be narrow (figs. 4 and 5). The temperatures were recorded at that point when the vertical amplitude of the action potential was decreased to 50 per cent of its original control height. In each of the

12 applications of heat this point was reached between 48.5 and 51.6 C. This was the critical range of temperature irrespective of the time required to increase the temperature up to that critical level. Once the critical range of temperature had been reached, no further increase of temperature was required to bring about complete flattening of the action potential. Maintaining the nerve for two to eight minutes at that temperature at which the action potential first showed a decrease gradually resulted in complete loss of the action potential (flattening of the curve).

Temperatures Produced by Application of Ultrasonic Energy.—Immediately after 16 of the applications of ultrasonic energy over the sciatic nerve, curves of the temperature changes in the region of the nerve were recorded. Figure 4 shows the two types of cooling curves representative of the six applications in which the action potential was decreased. The example on the left, representative of three of these six applications, indicates that temperatures during application of ultrasonic energy were within or above the critical range of temperature for the sciatic nerve. However, the example on the right, representative of the other three applications, suggests that the temperatures reached during the application of ultrasonic energy were below this critical range, although the action potential was affected. Figure 5 shows the two types of cooling curves representative of the 10 applications of ultrasonic energy in which the action potential was not affected. The example on the left, representative of six of these 10 applications, indicates that the temperatures reached during the application of ultrasonic energy were below the critical range of temperature, whereas the example on the right, representative of the other four applications, suggests that the temperatures reached during the application of ultrasonic energy were probably within the critical range of temperature even though the action potential was not affected.

Effects of Ultrasonic Energy on the Sciatic Nerve Twenty-Four Hours or More After Application.—None of the six dogs to which ultrasonic energy in doses of 5.0 watts per square centimeter for 10 minutes had been applied showed any apparent evidence of impairment of function of the nerve 24 hours after the application. At this time the action potential of the treated sciatic nerve of one of the dogs was generally of the same pattern as that of the untreated sciatic nerve on the opposite side. Three of the dogs received no further applications. They were observed for six weeks during which time no changes in the nerve and the structures innervated by it could be detected.

The two remaining dogs received a second application of ultrasonic energy over the sciatic nerve 24 hours after the first. There was no apparent evidence of involvement of the treated sciatic nerve 24 hours after the second application. On one of these dogs the action potential of the twice treated sciatic nerve was generally the same as that of the untreated sciatic nerve on the opposite side. In the sixth dog a third application of ultrasonic energy was made over the sciatic nerve 24 hours after the second application. This third application resulted in flaccid paralysis of the muscles below the knee. No action potential could be elicited in this nerve. It did not respond to electrical stimulation.

Results of Histopathological Studies

Effects of Ultrasonic Energy on the Spinal Cord.—Marked destruction of the lower part of the spinal cord, of the cauda equina or of both occurred in every dog and rat which exhibited paralysis following application of ultrasonic energy over the cord. Even in the one dog with no obvious paralysis and in the dog which exhibited only temporary incoordination in gait, there was partial destruction of the cauda equina. This damage resulted from

application of ultrasonic energy at a lower level along the vertebrae than in the other dogs. Consequently, the neurological changes were not extensive enough to be easily observed, as in the others with higher lesions.

The destruction in the spinal cord and dura was evident on inspection of the gross specimen and was limited to the area of application of ultrasonic energy. There was brown discoloration with liquefaction of the affected region. The tissue in this area was very friable. The microscopic appearance of sections stained with hematoxylin and eosin was that of necrosis of the spinal cord. In some sections dissolution and interruption of continuity of nearly all the tissue structures, including axis-cylinders, myelin and nerve cell bodies, were demonstrable. However, little damage was seen in blood vessels and mesenchymal supporting structures. There was evidence of proliferation of endothelial cells with the formation of new capillaries and the removal of degenerative tissue by mononuclear phagocytic cells (Gitterzellen). In some areas of the gray matter chromatolysis of the nerve cells was almost complete with loss of their staining properties. Pyknosis and fragmentation of nuclei were evident.

Destruction and degeneration of white matter also had occurred. There were nodular enlargements and fragmentation of axis-cylinders. This change was particularly apparent in preparations made with Bielschowsky's stains. The myelin stained poorly and was filled with large clear vacuoles. This was well shown in preparations made with Weigert's stain.

The changes found in the fibers of the cauda equina and spinal nerve roots were remarkably different in appearance from those just described for the white matter. The material in the myelin which stained appeared to be clumped into small dense bands across the fiber, leaving clear empty spaces between them. In longitudinal sections the bands appeared to be regularly spaced along the nerve fibers at right angles to the axis-cylinder. These changes in the myelin were uniformly distributed throughout the affected spinal nerve roots.

Effects of Direct Heat on the Sciatic Nerve. — When direct heat was applied to the sciatic nerve until its action potential was blocked, a pronounced change in the myelin occurred. This change was a constant and characteristic result of heat. It had the appearance of a clumping of the staining material of the myelin into dense, regularly spaced bands across the fiber, much like the changes produced in the spinal nerve roots by ultrasonic energy. The changes in the myelin were uniformly distributed throughout all the nerve fibers. Numerous nodular enlargements of the axis-cylinders were seen in preparations made with Bielschowsky's stain.

Effects of Ultrasonic Energy on the Sciatic Nerve. — A similar change took place in the myelin of the nerves in which ultrasonic energy had blocked the action potential. However, in these nerves the changes were not uniformly distributed. The myelin in many of the fibers examined in longitudinal sections appeared to have undergone no changes. The unusual regular pattern of myelin degeneration occurred in only every third or fourth fiber and in these for only a short distance of the fiber. In only one instance did the nerve have the same appearance as those affected by heat, in which the myelin was affected in every fiber. This was the nerve to which ultrasonic energy had been applied daily for three days with the final result of an obvious paralysis.

Comment

The outstanding feature of this study is the marked variability of the effects of ultrasonic energy. When the variable behavior of ultrasonic energy in

tissues is determined, the variability of results in these experimental studies can be understood better.

Every time ultrasonic energy passes from one type of medium to another, some loss of energy takes place through such phenomena as reflection and absorption. The dissipation of this lost energy results in the development of heat. Consequently, every time ultrasonic energy passes from water to skin, skin to subcutaneous tissue and subcutaneous tissue to muscle, there is loss of energy which may take the form of heat. The angle at which the ultrasonic wave is incident on a given medium also influences the amount of energy lost. The wavelength of sound in tissues at a frequency of 800,000 cycles per second is only 1 to 2 mm. Taking these factors into consideration, one can appreciate the many variations which may occur in ultrasonic energy as it passes through the tissues to the sciatic nerve deep in the thigh.

The tissues overlying the sciatic nerve were examined immediately after the application of ultrasonic energy. Erythema and edema of the skin and subcutaneous tissues were present which varied in degree from moderate to severe. After prolonged applications necrosis of this area often occurred. The depth to which these changes penetrated was remarkably variable. Visual inspection and histological studies showed that in some cases there were no apparent changes in the tissues beneath the outer fascial covering of the muscle. These changes involved the skin and subcutaneous tissues down to the muscle, the surface of which was glistening and appeared unaffected. However, in other cases a brownish discoloration of all tissues extended from the area of application straight through the entire limb. A severe necrotic lesion occasionally occurred in the skin on the opposite side of the leg at the point of exit of the ultrasonic energy. This unique effect was observed after only a few of the applications of maximal output of the ultrasonic generator and was not consistently accompanied with blocking of the action potential of the sciatic nerve. Conversely, the sciatic nerve was often affected when there was no visible evidence of damage to the tissues overlying it.

It is surprising that ultrasonic energy produced such marked damage to the cord with so little increase in the temperatures recorded in the cord. It has been reported[14] that although spinal reflex activity in the cat decreases in magnitude with increasing body temperatures of more than 38 C., reflex activity was still definitely present at 42 C. Teschan and Gellhorn[15] have found that heating the exposed cortical surface of the brain by infrared rays to 46 C. for thirty minutes may be tolerated without change in threshold for electrical stimulation of the motor cortex. Therefore, there is some justification in suspecting that increasing the temperature in the spinal canal to only 42 or 43 C. might not have resulted in the marked destruction which ultrasonic energy produced in the spinal cord. This consideration lends support to those who maintain that there is an effect of ultrasonic energy on nerve in addition to its heating effect.

The results of the study on temperatures produced in the region of the sciatic nerve by ultrasonic energy are examples of the wide variability of its behavior in tissues. If all the cooling curves were similar to the one on the left in figure 4 when the action potential was blocked by ultrasonic energy and if all were like the cooling curve on the left in figure 5 when the action potential was unaffected, then one could have said that the effect of ultrasonic energy on nerve tissue depends on temperature. However, since there are seven ex-

14. Storm van Leeuwen, W., and van der Made, M.: Über den Einfluss der Temperatur auf die Reflexfunktionen des Rückenmarkes von Warmblütern und Kaltblütern, Arch. f. d. ges. Physiol. **165**:37 (Aug.) 1916.

15. Teschan, P., and Gellhorn, E.: Influence of Increased Temperature on Activity of the Cerebral Cortex, Am. J. Physiol. **159**:1 (Oct.) 1949.

ceptions to this out of 16 applications, this statement cannot be made. Neither can one conclude from the data collected in this temperature study that there is an effect of ultrasonic energy on nerve tissue other than that of heat. It should be understood that the temperature measured by the thermistor represents the average temperature of the mass in which the thermistor bead is placed and may not indicate local "hot spots" which might be produced by ultrasonic energy.

Some questions arise regarding the partial recovery of the action potential in the first one to four hours after some of the applications of ultrasonic energy over the sciatic nerve. Would this partial recovery gradually become complete if a long enough period of 24 to 72 hours were allowed? To perform an experiment of such long duration was not feasible. Since an effect on the action potential was not produced with every application of ultrasonic energy, it would have been necessary to use a larger number of dogs for a study of this type in order for the results to be significant. Nevertheless, even with the small number of dogs used, only six, it is worth noting that three daily applications of maximal doses of ultrasonic energy had to be made before any changes could be detected 24 hours later.

Ultrasonic energy had a greater destructive effect on the spinal cord than on the sciatic nerve to which an equal dose was applied. This may be due in part to the spinal cord being a greater mass of fat-containing tissue and also to the difference in physical relationships. The spinal cord is surrounded by rigid bone, whereas the sciatic nerve is deeply imbedded in soft tissues. It recently was found[16] that a dose of ultrasonic energy has a greater heating effect on bone than on its surrounding tissues.

The evidence obtained from this work does not furnish an explanation for the difference in the reaction of myelin in the spinal cord to ultrasonic energy from that of myelin in the spinal nerve roots and peripheral nerves. The presence of a sheath of Schwann on the latter two structures may be a factor in this difference in reaction of myelin, as it also may be a factor in wallerian degeneration, which is seen only in nerves and not in the spinal cord.

The unusual regular pattern of degeneration of myelin, which occurred in every case in which heat was applied to the sciatic nerve and which was evenly distributed throughout every fiber of the affected portion of the nerve can be considered an effect of heat. The nerves which received an application of ultrasonic energy also showed this unusual regular pattern of degeneration of myelin but to a less degree and with an uneven distribution. These differences in the pattern of myelin degeneration occurred even though the same end point, that is, complete blocking of the action potential, was used for the application of both heat and ultrasonic energy. These differences in the reaction of myelin to heat and to ultrasonic energy also lend support to those who maintain that there is an effect of ultrasonic energy on nerve other than its heating effect. The irregular destructive pattern produced by ultrasonic energy is to be expected, since on transmission through the tissues maximal and minimal levels of energy due to the characteristics of the wave propagation occur.

Whether ultrasonic energy can be safely used for therapy cannot be determined from this study, which only begins the approach to the question. It is apparent that by use of maximal doses with the stationary technic of application, ultrasonic energy can cause destruction in nerve tissue, especially in the spinal cord. Perhaps a safe procedure for the therapeutic application of ul-

16. Nelson, P. A.; Herrick, J. F., and Krusen, F. H.: Temperatures Produced in Bone Marrow, Bone and Adjacent Tissues by Ultrasonic Diathermy: An Experimental Study, Arch. Phys Med. 31:687 (Nov.) 1950.

trasonic energy can be determined by further studies, if the moving technic of application (or pulsed energy) and smaller doses are used.

Summary and Conclusions

Ultrasonic energy applied in maximal doses over the lower vertebrae of both dogs and rats resulted in paralysis of the hindlegs and tail.

Ultrasonic energy in the amount of 3.0 to 5.8 watts per square centimeter applied to the midthigh resulted in complete blocking of, or at least 50 per cent decrease in, the action potential of the intact sciatic nerve in 60 per cent of the dogs studied. Recovery of the nerve as indicated by the action potential was usually complete when the action potential had been only partially decreased by ultrasonic energy, but recovery was generally incomplete when the amplitude of the action potential had been completely flattened.

The action potential of the sciatic nerve was decreased by direct heating in a manner strikingly similar to that produced by ultrasonic energy. For the sciatic nerve of the dog there was a critical range of temperature, from 48.5 to 51.6 C., at which the action potential of the nerve was reduced 50 per cent or more. Cooling curves following the application of ultrasonic energy gave evidence of the markedly variable behavior of ultrasonic energy in tissues.

Only after three daily applications of ultrasonic energy, 5.0 watts per square centimeter for 10 minutes, was any impairment of function of the intact sciatic nerve noted 24 hours after the last application.

With the same doses applied externally, ultrasonic energy had much greater destructive effect on the spinal cord than on the sciatic nerve.

The reaction of myelin in the spinal cord to ultrasonic energy was different from the reaction of myelin in the spinal nerve roots and peripheral nerve.

The unusual regular pattern of degeneration of myelin, which occurred in every case in which heat had completely blocked the action potential of the sciatic nerve and which occurred evenly distributed throughout every fiber of the affected portion of the nerve can be considered a heat effect.

The nerves in which ultrasonic energy had completely blocked the action potential also showed this unusual regular pattern of myelin degeneration but to a less degree and with an uneven distribution.

To those who maintain that there is an effect of ultrasonic energy on nerve tissue other than its heat effect, support is given by two findings: (1) the occurrence of marked destruction of the cord when temperatures recorded in the spinal canal were as low as 42 to 43 C. after application of ultrasonic energy and (2) sciatic nerves which had their action potential completely blocked by application of ultrasonic energy showed much less histological evidence of the unusual regular pattern of degeneration of myelin which is an effect of heat than sciatic nerves in which the action potential had been similarly completely blocked by direct heating.

The discussion of this paper will be published in a later issue of THE ARCHIVES.

HEAD TRACTION ATTACHED TO CORSET IN CARE OF SCOLIOSIS

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The treatment of scoliosis by preventive or corrective physical measures is probably the most difficult problem faced by the physiatrist in the care of neuromuscular diseases. The goal of his endeavors is to restore and/or maintain normal alinement of the spine, or at least to maintain sufficient mobility that growth will not cause increased curvature, and to hold maximum correction by his conservative methods so that any necessary surgical procedure can be deferred until the optimum age for greatest success.

To appreciate fully the value and the limitations of the head traction apparatus, several points in the conservative care of scoliosis must be emphasized.

1. The importance of scoliosis can be realized only by working with the severe end stages of this deformity, but the factors responsible for the beginning of these curves are by that time obscure, and classifications of scoliosis at that stage are of little value to those who are interested in care of scoliosis by the prevention of significant structural changes.

2. The cause of a structural scoliosis is the same as the cause of skeletal deformity in other bodily segments: persistent faulty alinement of those structures during rest and/or activity. If faulty alinement persists long enough, particularly under the stresses of activity and bodily growth, irreversible structural changes must take place.

3. Physical measures are of very limited value in correcting, or even holding, structural scoliosis.

4. Physical measures can prevent or minimize the development of significant curves only if all the causative and accelerating factors are recognized and corrected before the irreversible changes take place in fascial, ligamentous, muscular and osseus tissues. Scoliosis has become the dreaded problem that it is chiefly because of failure thoroughly to examine the spine immediately and repeatedly after recognition of neuromuscular faults in any one of the bodily segments. The earliest signs of faulty alinement are, in most cases, seen in anteroposterior roentgenograms of the spine in sitting or standing positions before clinical evidence is obtainable.

5. Specific, localized stretching of fascial, ligamentous and muscular tissues to maintain or restore symmetrical mobility, and specific localized muscle reeducation to restore adequate functional strength and balance, are the basic tools that we use. However, when faulty alinement exists and while these tools are being used to overcome tightness, muscular weakness and imbalance, there is the need for additional help to hold the gains made to minimize the stress of necessary physical activity between the periods of treatment. Here we must rely on some combination of bed rest, restriction of activity and supportive apparatus. The limitations of bed rest and restriction of activity are obvious and need not be discussed here.

If the spine is symmetrically mobile and diffuse weakness of the trunk musculature makes it impossible for the patient to sit or stand without slump-

ing into a long lateral curve, then a well fitting corset or back brace is usually sufficient to maintain safe alinement. However, a simple corset, jacket or back brace has little effect on localized curves above the dorsolumbar junction, or on the low lumbar curves due to tightness of the iliolumbar and/or iliotibial fascia. These appliances frequently have crutchlike extensions upward to the axilla. These give support to the upper back but have little effect on lateral dorsal curves. All kinds of pressure pads, straps and slings have been devised to hold the spine in position. From experience it is the author's opinion that no curve of any significance can be corrected or even held by any apparatus that depends on pressure against the rib cage for its holding or corrective force. The failure is due not only to the inability to apply specific force against the spine through anterolateral pressure against the thorax but also to the inability to anchor the apparatus at hip level to counteract effectively the force of the attempted correction above.

These appliances have no significant value in the highly deforming and rapidly progressive high dorsal curve. The only possible way, by apparatus, of holding or correcting these lateral and rotary dorsal curves is by some means of exerting linear traction that stretches the spine upward and carries some of the weight of the head, upper extremities and thorax. The Brewster jacket and the Blount (or Milwaukee) frame are examples of results of the attempt to apply this type of force in different ways. The Brewster jacket attempts to shift and lift the thorax into position by spring-powered pressure under and around the inferior costal margins. The Blount frame is a means of producing a direct stretch between the head and the pelvis as well as applying pressure by adjustable pads placed against the thorax. This apparatus has the disadvantage of being difficult and expensive to construct, awkward and conspicuous to wear. It is not well suited to a conservative program of long duration. It is, or course, recognized that the frame has other orthopedic significance.

Any apparatus designed to play a part in the over-all program as suggested above must fulfil certain criteria:

1. It must be practical — that is, it must be possible to construct in any good brace shop, and it must be reasonable in price.
2. It must not seriously handicap the permitted activities in a program of modified activity — that is, the child must be able to move about easily, go to school, etc., within the limits imposed by his other physical disabilities.
3. It must permit easy adjustment to keep pace with treatment results and growth.

The head traction to be described fulfils these requirements reasonably well. The results obtained to date on some 36 patients are highly encouraging.

The apparatus consists of a device for stretching the spine by providing pressure downward against the iliac crests and upward against the occiput and mandible (figs. 1 and 2). The most practical and effective way of providing fixation at the pelvis appears to be by applying a modified simple corset. The basic corset is made of cotton twill with two or three pairs of metal stays posteriorly and fastened in front by cloth straps and metal buckles. The front of the corset is reenforced with one pair of light stays. Particular attention is paid to having the corset fit snugly about the waist and comfortably over the iliac crests and anterior spines. To provide greater rigidity ½ to ¾ inch widths of aluminum bars (24 S. T. Aluminum, die No. 538-D) are riveted to the ends of the posterior corset stays. To prevent the corset from slipping downward or around the hips, two aluminum bars similar to the above are fastened to the corset the back at or below the level of the posterior iliac spine and curved to fit snugly over the iliac crests. The distal third that fits over the crest is also twisted into a more horizontal position and covered with sponge rubber and moleskin. The use and proper positioning of these bars is very important to effective traction.

Fig. 1. — Patient wearing head traction apparatus attached to corset; leather flap protects clothing.

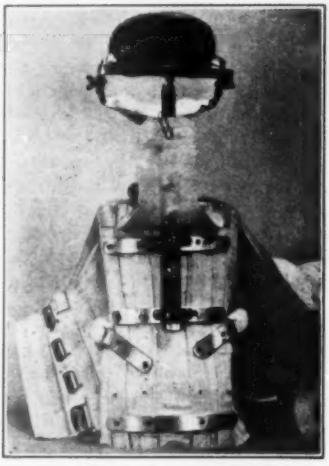

Fig. 2. — Flap lifted to show method of attaching upright to corset and pressure screws to permit adjustment of upright within steel sleeve.

The only practical way of applying upward pressure to the head is by means of fitted cups against the mandible and the occiput and attached to the corset by a metal upright (fig. 3). The chin and occiputal pieces are made of fashioned sheet aluminum

Fig. 3. — Head piece to show method of adjusting fit and head band to minimize pressure on chin.

(24 S. T.) 0.065 to 0.076 inch thick, covered on the inside with sponge rubber and soft leather. These pieces are held together by bars of Monel metal (cold rolled, one-half hard) 0.109 inch thick and varying in width (½, ⅝ or ¾ inch) according to size of

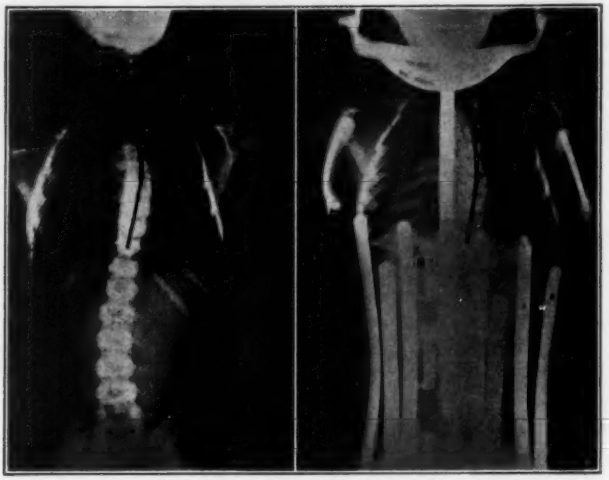

Fig. 4. — Right mid dorsal curve of one year's duration immediately before and after application of head traction apparatus.

head piece. The chin piece is removable and adjustable by its fitting into a sleeve of rectangular tubing (wall thickness 0.042 inch, inside diameter ⅛ by 17/32, 41/64 or 49/64 inch, depending on the width of the Monel bar).

The upright between the corset and the head piece is likewise of Monel metal and

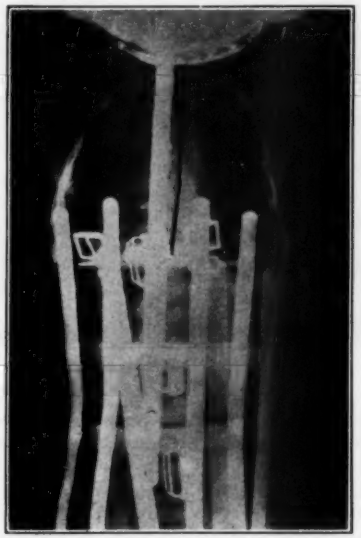

Fig. 5. — Same curve shown in figure 4, two months later.

attached to the corset by means of a rectangular steel sleeve (as noted above). The upright is adjustable within the sleeve and is held in position by hollow-headed set screws inside machine screw nuts welded to the tubing. This upright is fashioned to conform

Fig. 6. — Right total C-curve in patient with severe quadriplegia before and after wearing head traction apparatus 2½ months.

to the normal contour of the erect cervicodorsal spine. The simple Allen wrench is used to adjust these screws. The attachment at the head piece is hinged to permit flexion and extension of the head with the traction in place.

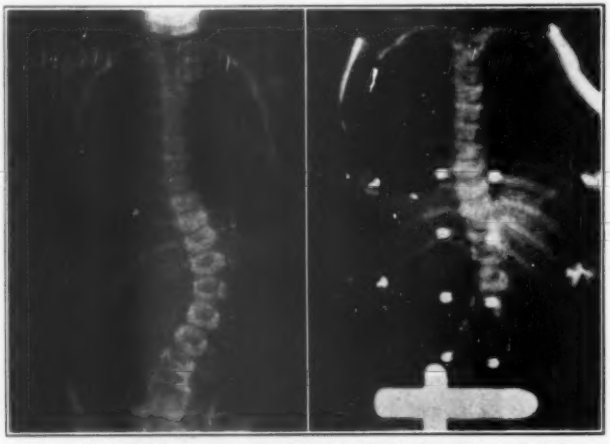

Fig. 7. — Right high lumbar curve immediately before and after application of cellulose acetate jacket.

After the traction apparatus has been fitted satisfactorily it is important to have the therapist, parents and the patient understand the reason for and the proper use of the appliance. It is put on with no traction and the upright loose in the sleeve. The chin piece is then slid into position so that the occiputal piece fits close to the cervical spine and as far under the occiput as is possible. The occipital piece must not slide up the back of the head. The upright is then pulled upward to exert traction, and when it is in satisfactory

position the hollow head screws are tightened. Traction is applied to the patient's tolerance and a line scored on the metal upright to denote its position. The apparatus is worn as many hours during the day and night as possible. Patients with mild curves when the spine is mobile, need wear it only when the they are sitting, standing or walking. Patients with severer curves may have to wear the apparatus day and night. Obviously, it should be adjusted regularly to see that as much traction as can be tolerated is being exerted.

Proper care of the skin over the chin is important. The skin should be kept clean, rubbed with alcohol and talcum powder. Moleskin may be placed over the leather and changed frequently for cleanliness. If irritation and infection occur, the traction should be removed and the patient kept in bed for several days until the skin clears. Here penicillin ointment is of great value.

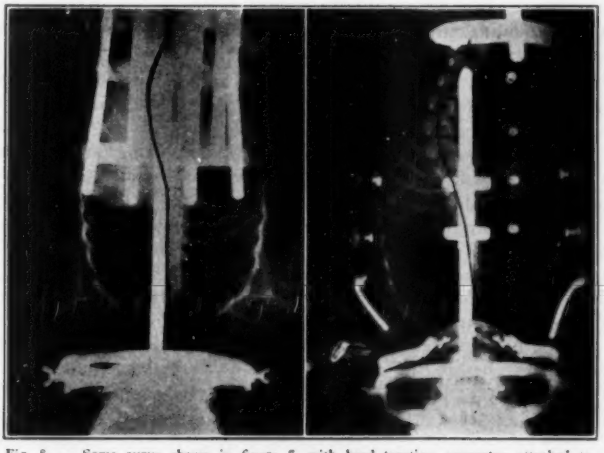

Fig. 8. — Same curve shown in figure 7, with head traction apparatus attached to jacket and to corset.

This apparatus was originally designed for control of high dorsal scoliosis; however, it is being used in control of middorsal, lower dorsal and dorsolumbar curves with success that appears to be directly proportional to the height of the curve. The higher the curve the better the correction, provided, of course, that the spine in one case is as mobile as in another. Examples of the use of this apparatus on three levels of scoliosis are shown in figures 4 through 8.

Summary

1. The control of scoliosis by conservative measures depends on very early recognition of the causative and accelerating factors and prompt restriction of activity, on physical therapy and on supportive apparatus.

2. Commonly used corsets, jackets or back braces are usually ineffective in correcting or even holding a scoliosis, particularly if they depend on pressure against the rib cage for the force of correction.

3. A type of traction brace is described to be used as a means of holding and perhaps augmenting the gains made by intelligent physical therapy.

FITTING AND ALINEMENT OF BRACES FOR LOWER EXTREMITIES *

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Braces for the lower extremity can be classified under two broad groups. The first includes braces for correction of deformities. These braces and splints are worn primarily when at rest and at night. Their main function is to prevent formation of deformities, to correct deformities and to maintain correction already obtained by conservative or operative treatment. The second, and by far the larger group, is comprised of braces for locomotion. The main object of these braces is to restore, improve and increase the ability to walk by providing an efficient weight-bearing support and stabilization of the extremity.

Braces for locomotion are usually divided into (1) weight-bearing braces, which eliminate entirely all stress on the extremity by taking weight on the ischial tuberosity, and (2) functional braces, mostly used for disabilities caused by neuromuscular dysfunction. Only the fitting and alinement of functional braces for lower extremities will be considered in this paper.

Basically, the object of a functional brace is not to support the body weight but to maintain the body postural alinement as nearly normal as possible. The effect should result in helping the weakened muscle groups restore weight-bearing stability to the extremity, combined with normal line of gravity and preservation of maximal and optimal joint function, but it should not completely replace these muscles. It should prevent deformities, but it cannot be expected to correct them unless they are of a very mild type. Therefore, before the application of a brace, it is first necessary to correct, as far as possible, all existing deformities.

An intelligent selection of an efficiently designed and properly fitting brace is just as essential as is the skilful execution of a surgical operation. The prescription for the brace must be made by the physician. This responsibility cannot and must not be delegated to the brace maker. The physician prescribing the appliance should have a good knowledge of the mechanics, technic, possibilities and limitations of modern brace making.[1] He must understand what a brace is to accomplish and how it should be constructed. The physician should write a prescription specifying in detail what type of brace he desires, what correction it should accomplish and what disabilities it should eliminate. He should inspect the skeleton brace when it is being fitted and after it is completed. He must see that it carries out the purpose for which it was designed. He must know what to recommend when difficulties arise.

In selecting a brace, it is necessary to consider the age of the patient, his occupation and his social and economic status. It is obvious that the history, general physical and mental state and diagnosis should be known. In addition, the evaluation of the extent of physical disability is the most important criterion for determining the type of brace that the patient will require.

* Published with permission of the Chief Medical Director, Department of Medicine and Surgery, Veterans Administration, who assumes no responsibility for the opinions expressed or the conclusions drawn by the author.

1. Jordan, H. H.: Orthopedic Appliances, New York, Oxford University Press, 1939.

This evaluation is based on repeated analysis of muscle function. This should note the muscle strength, flexibility, extensibility and stability not only of the affected joints but of all joints of both extremities. As each muscle has an essential function, weakness or paralysis of any muscle or group of muscles will result in certain proportionate disability. Because muscles vary in importance as they do in strength, the ultimate disability caused by weakness or paralysis may be predicted with accuracy after a thorough analysis. It is important to remember that such initial muscular disability may show gradual improvement necessitating a change in the type of brace to be prescribed. Therefore, it is essential that the patient's disability be followed closely until it becomes fixed.

The alinement of a brace is based on certain fundamental anatomical and biophysical principles, and the understanding of these is essential for a successful fitting. It is not sufficient only to aline the brace to the extremity, but the various parts of the brace have to have the proper relation to one another and to the weight-bearing line of the extremity. In the normal lower limb in an erect position the axis of gravity runs from just medial to the center of the head of the femur and passes through the center of the knee joint and to the ground slightly medial to the midline of the os calcis (fig. 1).

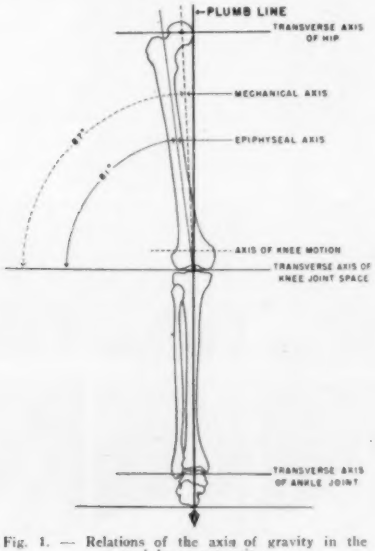

Fig. 1. — Relations of the axis of gravity in the normal lower extremity.

A brace will fit only if the axes of the artificial joints are in line with the axes of the natural joints. It should be constructed to conform to the alinement of the skeleton, even if this should happen to be abnormal. Otherwise, it will not fit comfortably.

To permit good weight bearing and a functional foot, a brace should

1. Allow the body weight to be distributed evenly over the plantar surface of the foot. It must maintain the normal weight-bearing axis from the tibia down through the talus and out through the second metatarsal bone to the second toe. It should provide the maximal amount of "push off" during locomotion.

2. Provide a foot alined with the ankle joint. The alinement must conform to the normal axis of the foot in relation to the long axis of the tibia. It should maintain proper supination of the foot; otherwise, it may cause painful complications. The heel should be well positioned in the lateral plane.
3. Give good lateral stability to the foot despite the muscle imbalance present.
4. Retain the maximal and optimal amount of motion in the ankle.

If a foot plate is used, it should incorporate all these factors to provide a good functional foot. A foot plate should be used rarely. The only definite type of abnormality in which it may be required is in calcaneus deformity, to hold the foot in a neutral or slightly equinus position. The disadvantage of a foot plate is that it is difficult to fit it to the foot and into the shoe. A wider shoe is required, and on weight bearing it causes pressure on the foot.

Ankle Joint

The artificial ankle joints should be alined with the axis of the tibiotalar articulation. This articulation permits dorsal and plantar flexion. The transverse axis of this joint runs obliquely between the malleoli from the posterior and lateral side to the anterior and medial aspect of the foot. The diagonal position of this axis during normal locomotion causes a certain degree of rotation, or what is called "toe-out." Because of mechanical difficulties, most of the present day braces do not permit this rotation and during walking impose a certain degree of limitation. Braces, as alined today, have the artificial ankle joint centered transversely about ¼ to ½ inch above the tip of the lateral malleolus.

The most physiologic functional brace is one with a stirrup type ankle joint. In the caliper type brace, the joint is located in the heel of the shoe. This is unsound for functional use, since it does not allow proper physiologic motion in the ankle joint. In analysis of such a brace during locomotion, it

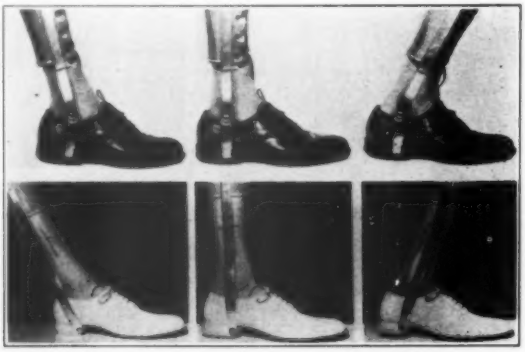

Fig. 2. — Comparison of caliper with stirrup type ankle joint. Note motion of upright bars in the caliper brace.

becomes evident that the upright bars move backward and forward with each step (fig. 2). This lack of stability is most evident in the leg, and it is not even prevented by the use of a wide cuff about the calf. If stability of the uprights is obtained by the calf band, then the foot moves forward and backward in the shoe. If a T strap is required, then the complication is increased because on dorsiflexion this T strap is relaxed and on plantar flexion it becomes taut. If a detachable brace is required, then a stirrup type ankle can be used with caliper-like attachments to the shoe.

Ankle joints can have free motion or have stops to provide limited motion as the condition may require. In an equinus foot, usually 5 to 10 degrees of plantar flexion is permitted. To prevent too excessive dorsiflexion, which could interfere with the gait, the motion is usually limited between 10 and 15 degrees. A spring type brace (such as the Klenzak-Pope) will provide this limited motion. A brace for a calcaneus foot must be absolutely rigid and have a heavy ankle joint with reversed stops. It may be attached to a molded foot plate. It must have a heavy corset over the foot to hold it down in position. If this deformity is due to the loss of function of the calf muscle group, then on walking it is impossible to propel the body forward. In such case it is necessary to keep the center of gravity posterior to the normal ankle axis to prevent automatic dorsiflexion of this joint. Therefore, the artificial ankle joints should be located posterior to the malleoli.

T Straps

When the forefoot shows medial or lateral deviation, a T strap is commonly used to correct this disability. The position of the T strap is important. It should be placed over the joints in which the deviation takes place, i. e.,

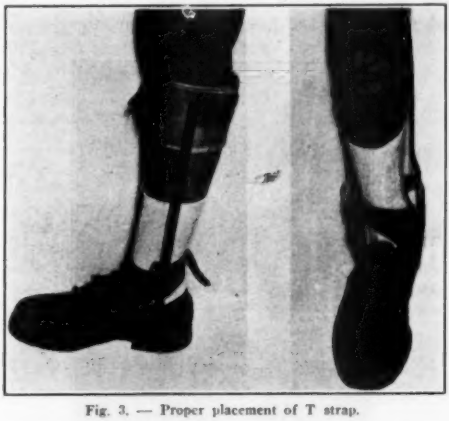

Fig. 3. — Proper placement of T strap.

over the subastragalar and midtarsal joints. The T strap should be placed well forward in front of the upright bars and over the axes of these joints (fig. 3). It should start just above the sole of the shoe. For a varus deformity, the T strap should start on the lateral border of the foot and should be affixed to the medial bar. For a valgus deformity, the positions should be reversed. In certain cases of deviation of the forefoot, T straps can be eliminated by using wedges on the shoes.

Leg Bars, Tibial Band and Cuffs

The upright bars should conform to the contour of the leg and should clear the ankle joint. They should extend from the malleoli to the most prominent part of the calf. When the alinement is good, these bars will not move on the leg during locomotion. The leg bars are connected with each other by semicircular metal bands. The tibial metal band should be placed over the most prominent part of the calf. It should be of good steel,

about 1½ inches wide and extend around half the circumference of the calf. It should be covered by a leather cuff, which should conform to the leg. All tibial cuffs should be molded to the leg. If placed above the most prominent part, they should be narrower at the top; if placed below, then the lower end should be narrower. To permit a constant contact with the calf, a riding cuff can be used. This cuff is riveted to the metal band in only one place on each side. This allows it to adapt itself to the changes of position caused by contraction of the calf muscles. This will eliminate some chaffing of the skin. In a calcaneus brace, the metal band with a cuff may be placed over the anterior aspect of the leg to facilitate the application of the brace.

When additional support or stabilization is needed, then a small spring band and cuff are placed 2 to 3 inches above the malleoli. As a rule, an additional band is required with all detachable braces. Occasionally, when the disability indicates, a molded leather corset can be used instead of bands and cuffs. This corset conforms in every detail to the limb, regardless of the deformity present. It gives an excellent contact with the extremity without causing undue pressure. It also increases the stability of the brace.

Knee Joint

In a long leg or thigh brace, the artificial knee joints should be placed in the axis of the motion of the knee articulation (fig. 4). This takes place

Fig. 4. — Roentgenogram of a braced knee showing the proper level of artificial joints.

through the femoral condyles and not through the joint space. Therefore, to secure a properly functioning brace, it is necessary to place the artificial hinges opposite the midpoint of the femoral condyles. The best method of determining this point in a person of average weight is to identify the prominences where the collateral ligaments are attached to the femur. If the location is chosen right, then there will be little if any motion in this spot when the patient flexes or extends the knee. If the joint is placed too high, it will interfere with flexion of the knee, causing pinching in the popliteal

space. Also, the skin of the leg is forced forward against the tibial cuff, causing undue pressure on the anterior margin of the tibia. This will prevent the patient from sitting for any length of time without discomfort. Moreover, the thigh cuff will be distorted, showing excessive pressure posteriorly and a gap anteriorly.

Similarly, when the joint is set too far forward, it will interfere with flexion, causing pinching in the popliteal space. In addition, the joint will protrude forward while in the sitting position. When the joint is too low, it will cause the thigh cuff to exert excessive pressure, resulting in restriction of circulation and discomfort. Also, there will be an open space in front of the tibial cuff and pinching in the back.

When the joint is placed too far back, excessive pressure is produced by the anterior parts of both thighs and tibial cuffs. Occasionally, to secure a certain amount of stability, the knee joints can be located slightly posterior to the line of gravity. This method can be used to eliminate knee locks in the presence of mild paralysis of the quadriceps and, at the same time, prevent a recurvatum deformity, but careful and skilful alinement is essential to prevent grave complications.

The artificial joints should be alined perpendicular to their axis and be so positioned that the two are on the same level from the ground. There is no agreement on the types of artificial joints to be used or on their number. It must be remembered that artificial joints have only motion in one plane, rotating about a fixed point, and they cannot imitate the normal motion of the knee, which combines rotation with a gliding movement. However, there are certain factors that have to be considered in selecting artificial knee joints:

1. The joints should not be bulky. This is especially important if a bilateral thigh brace is required.
2. The joints should be able to stand stress and strain without frequent breakdowns.
3. All joints should have stops to prevent hyperextension, unless the disability requires differently.
4. When knee locks are used, they should be placed on both sides to prevent rotation of the brace. Also, a single lock imposes too great a stress on that joint. Locks are used only if the muscle power is insufficient to stabilize the joint. To increase stability, a knee pad can be used.
5. The joints should not have excessive or sharp projections of the lower bars, as they will damage clothing.

To facilitate motion and approximate it more to the normal torque of the knee, bilateral double hinges have been used. The value of this procedure has not yet been proved, but, in my experience, they appear to facilitate motion and give more comfort to the patient. There are numerous disadvantages in this type of joint. Usually they are too bulky, have too complicated mechanisms and cannot withstand prolonged stress. I have used successfully a double joint designed by Slodek,[2] which is simple in construction and which proved to be very sturdy (fig. 5).

Thigh Bars, Bands and Cuffs

Every long leg brace should have double bars, as it is hard to hold an extremity securely with one upright bar, no matter how strong it may be. The bars are placed midway on the sides of the thigh. The lateral bar usually extends to about 3 inches below the trochanter, the medial bar to about 2 inches below the perineum. The lateral bar is usually about 1 inch longer than the medial. The bars must be rigidly connected by metal bands. Usually two bands are used. These bands should follow the contour of the thigh.

2. Slodek, Wallace: Personal Communication to the Author.

The inclination angle of these bars should be the same and should correspond to that of the thigh. The metal bands should extend half way around the thigh. The formula for their length is best determined by taking half of the circumference of the thigh at the level where they are to be placed and adding to it two widths of the upright bars. This will usually place the bars in the right position. The lower thigh band should be placed high enough above the knee to permit free motion of the hamstrings. The upper band is placed obliquely, the lateral side being about 1 inch higher than the

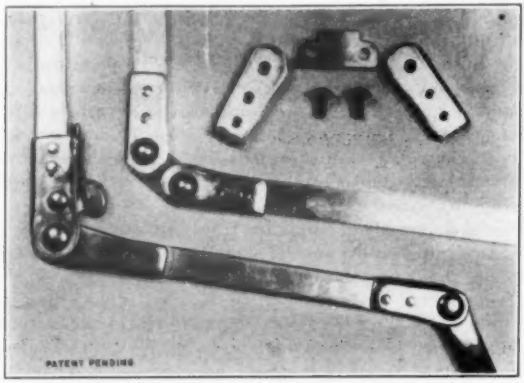

Fig. 5. — Different types of joints devised by Slodek.[2]

medial. Its upper edge should be parallel to the inguinal ligament and low enough to cause no undue pressure in this area. The bands should be made of the very best steel to preserve their normal shape. If inferior steel is used, they will flatten out during sitting, causing malalinement and springing of the brace.

The metal bands can have individual leather cuffs or they can be incorporated in a corset or lacer. This corset should allow sufficient space above the knee, and especially in the popliteal space, to prevent pressure complications in that region on flexion.

Trochanteric Joints

The hip or trochanteric joint is used in conjunction with a pelvic band or a back brace. Its function is to prevent abnormal motion at the hip, especially external or internal rotation, and provide stability. The trochanteric joint should be placed at the level of the tip of the greater trochanter and slightly anterior to it. The placement of this joint and its attachment to the pelvic band are important. If it is attached to the pelvic band too far anteriorly, it will cause the pelvic band to exert undue pressure anteriorly, producing a gap in the back, especially during sitting. If it is attached too far back, then there is excessive pressure in the posterior aspect of the pelvis. If the joint is placed too low, during locomotion it will cause the pelvic band or back brace to be thrust upward, creating a pressure on the posterior aspect of the thigh when the patient is sitting.

Malalinement of this joint will cause discomfort to the patient and interfere seriously with locomotion. Usually a free joint is used. Again the question whether to use a single or a double joint is debatable. Personally, I

prefer a double joint in this region, as it gives more freedom of motion and it interferes less during sitting (fig. 6).

Stops for limited motion can be used, if indicated, and hyperextension of 10 to 15 degrees is allowed to facilitate locomotion in certain cases of hip

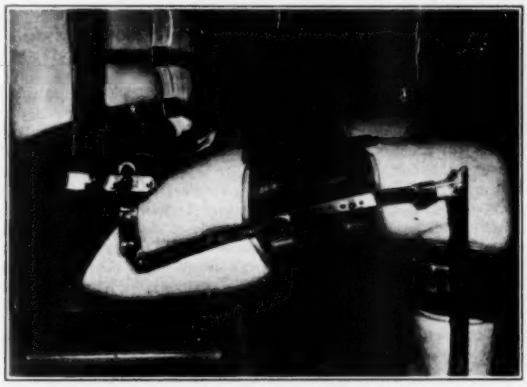

Fig. 6. — Double hip joint devised by Slodek.

extensor weakness. When there is extensive involvement of the trunk muscles, a lock has to be used. This will eliminate all motion in the hip but will provide stability.

Pelvic Band

The pelvic band should be placed horizontally around the pelvis between the anterior superior spines and the trochanters to avoid pressure over bony prominences. It should come around in front of the anterior superior spines to provide stability and prevent the pelvis from tilting forward. This band, made of metal, is usually about 1½ to 2 inches wide. It is lined with leather and is completed in front by a strap. In addition to providing the attachment for the trochanteric joint, it will limit excessive tilting of the pelvis. When a bilateral long leg brace is used, if possible, only one brace should be attached to the pelvic band or spinal brace. This will facilitate the application of the braces and permit better locomotion.

Determination of Proper Fit and Alinement

When a lower extremity brace is being examined for alinement and fit, the patient wearing his appliance should be stripped. This is important because it is only in this way that the relationship of postural mechanics can be seen. At first, the brace should be inspected with the patient in standing position; then the gait should be analyzed. After this, the alinement is checked in a sitting position; then the extremity is examined for evidence of pressure, and finally the brace itself is inspected for workmanship.

During the examination of a brace for proper alinement and fit, it is essential to note the following points:

1. Is the brace as a whole and each essential part smoothly fitted? Do the upright bars touch the skin? Is there sufficient, but not excessive, clearance between the brace and the knee and ankle joints? Does this clearance exceed ¼ to ¾ inch? Does it interfere with locomotion? Does the brace minimize the unbalanced action of muscles? Does it provide good stability?

2. Is the relative position of natural and artificial joints proper? Do the axes of artificial joints correspond with the axes of natural joints? Do the various parts of the brace have the proper relation to each other and to the weight-bearing line of gravity? Is there any motion between the extremity and the brace?

3. Is the foot in a good weight-bearing position? Is the motion permitted in the ankle joint optimal for the patient? If used, is the T strap in the proper position?

4. Are the bands and cuffs properly fitted to the contour of the soft parts so that half the limb is contained within them? Are the bands smoothly lined?

5. If used, is the pelvic band around the pelvis horizontally? Is the trochanteric joint attached in the proper place to the pelvic band?

6. Is the pressure and counterpressure equally distributed, or is it unequal, causing discomfort and pain? Are all bony prominences protected? Is there any pressure over the midtarsal region, at the insertion of the Achilles tendon to the calcaneus, on the malleoli, at the crest of the tibia, at the head of the fibula or at the patella? Are there any pressure sores in these areas? Has proper care been taken to avoid excessive pressure in cases in which skin shows trophic changes, where there is atrophy of subcutaneous tissues or muscles, or where there is disturbance in peripheral circulation?

7. Is the brace well but simply constructed? Is it strong and sturdy? Is it easily applied? Are there any undue sharp projections?

8. Is the brace designed for the patient's needs? Does it accomplish the task for which it was prescribed? Does it meet the demands of the patient's vocation or profession?

Functional braces for lower extremities should enable the patient to resume locomotion in general and, if possible, return to a gainful occupation. However, it is essential that such a patient receive adequate training in the proper use of his appliance. This has not been emphasized sufficiently. A brace which gives stability to the limb imposes certain limitations in the rotary components of motion during locomotion. This change causes altered motion of the individual body segments and disturbs the dynamic balance. Furthermore, there are changes in inertia, speed, acceleration and the location of the center of gravity caused by added weight or mechanical limitations of the brace. To correct these factors, training is necessary for balance and muscular coordination if effective ambulation and use of the appliance is to be expected.

Summary

1. Lower extremity braces are divided into two large groups, namely, braces for the correction of deformities, or the so-called night splints, and, second, braces for locomotion. There are two types of braces for locomotion: (*a*) weight-bearing braces, which eliminate entirely all stress and motion of the extremity, and (*b*) functional braces, which maintain the body postural alinement as normal as possible but preserve maximal and optimal joint function. Only functional braces are considered in this presentation.

2. The prescription for the brace must be made by the physician. He cannot and must not delegate this responsibility to the brace maker.

3. Functional braces are primarily for maintaining the body postural alinement as normal as possible. They should reestablish weight-bearing ability and a normal line of gravity and facilitate locomotion.

4. The alinement of a brace is based on certain fundamental anatomical and biophysical principles, of which the position of artificial joints in relation to natural joints is most important.

5. The various component parts of braces are discussed, and the proper alinement and fit are described.

6. A routine for examination of a brace for fitting and alinement is outlined.

7. Training in the proper use of a brace is emphasized.

Discussion on Papers of Dr. von Werssowetz and Dr. Bennett

Dr. Herman J. Flax (Santurce, Puerto Rico): This afternoon the speakers in their outstanding presentations practically covered the over-all problems of bracing the human body. The problem of scoliosis is not an easy one to handle, but Dr. Bennett clearly demonstrated his practical way of solving this problem by means of a head traction attached to a corset. Finally, Dr. von Werssowetz has discussed in great detail the fitting and alinement of braces for the lower extremities. These speakers presented their personal modification of braces, from the orthodox type of Dr. von Werssowetz to the ingenious, simple, functional head traction apparatus of Dr. Bennett.

In a discussion of bracing, there are a few fundamental considerations that bear repeating until they become indelible upon the minds of all of us who prescribe braces. I am extremely happy to have heard each individual speaker emphasize that it is the physician — in our case, the physiatrist — who should write the prescription for the brace. If we are lax with our brace prescriptions, how else can we expect the bracemaker to prepare the brace as we want it made, and also to understand the need for the adjustments that we think necessary? Not all of us are fortunate enough to have excellent facilities for the manufacture of orthopedic appliances. Therefore, it is essential that we get to know the orthotist in our community and evaluate the type of work that can be done locally. Although all of us want our braces to conform anatomically in structure, we must not get too scientific in our approach to this problem of bracing our patients and sacrifice function for perfection of detail. This takes far too much time in the preparation of the brace and adjustments, not to mention money. Certainly, the physiatrist who knows his brace and the shortcomings of his brace can best treat his own patients.

Each year, as a result of constant and much needed research — because our braces are still not perfect — brings to light a great many new modifications, new metals and also new high pressure salesmen. Fortunately, today the facilities of the testing laboratories of the Mellon Scaife Foundation offer all of us a valuable means of testing and approving new orthopedic appliances, free from all propaganda.

Again, may I caution those of you, who, like myself, must carry on for the present with whatever facilities are available in the community not to be too exacting in your desires but rather to remember the three criteria mentioned by Dr. Bennett:

1. The brace must be practical and easily available. It must be possible to construct this brace in your own community, and it must be reasonable in price. I recall the advice of Dr. George Deaver, who always cautioned us to "include in the initial cost of your brace the fees of the bracemaker for all the adjustment of one year. When it is necessary to adjust your brace, be sure that the patient and the bracemaker come to your office, where you can point out to him what adjustments you want."

2. We must remember that one of the functions of the brace is to allow our patient the greatest amount of activity within the deformities of his disease. This is especially true of the little people who want to be up and about.

3. It must permit easy adjustment to keep pace with treatment results and with the growth of the patient.

Dr. Bennett (closing): We have used the head traction apparatus on about 36 patients to date over a period somewhat less than two years. I cannot begin to tell you how long we may have to use this apparatus on specific patients. The use of this head traction is to provide support and, we hope, correction while other measures are being carried out, with the full hope that eventually the apparatus can be discarded completely. I am sure we all realize, however, that certain youngsters with severe weakness and curvatures in the spine may have to wear this, or similar, apparatus for the many years until full bone growth and stability occurs.

THE USE AND ABUSE OF PHYSICAL MEDICINE IN THE TREATMENT OF PERIPHERAL VASCULAR DISEASES *

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WASHINGTON, D. C.

Although there have been many changes in the methods used for increasing blood flow to the ischemic extremity during the past 20 years, the basic management of patients with peripheral vascular disease has remained essentially the same. Many of the measures used in treating circulatory disturbances a decade ago have been abandoned. Some forms of therapy lacked physiological or pharmacological justification, although improvement had been reported following their use. Others, which were theoretically sound, failed to produce results superior to simpler and less expensive methods of treatment. Inasmuch as unmeasurable factors, such as the patient's emotional reaction to treatment, can alter the course of most chronic diseases, it is understandable why no satisfactory yardstick is available for estimating the total effect of any specific form of therapy. The least one can demand of a method advocated for the treatment of circulatory disturbances is that it be capable of improving the circulation not only temporarily but permanently. Instrumental methods, requiring expensive equipment and technical assistance, have no value over simpler procedures unless they are capable of producing a rapider and more lasting increase in circulation. The critical attitude of physiatrists concerning methods used for improving blood flow is reflected in the numerous reports on the quantitative evaluation of these procedures.

While the diagnosis of peripheral vascular disease is beyond the scope of this discussion, it should be emphasized that the ability of the physiatrist to detect misdiagnosed vascular disease is the first line of defence against mismanagement of these conditions. The majority of patients with wrong diagnoses are referred to him for treatment of a suspected musculoskeletal or neurological disorder. Likewise, recognition of functional circulatory disturbances mislabeled as organic disease protects the patient from a long period of unproductive therapy. Distinguishing between functional and organic arterial disease is equal in importance to the detection of misdiagnosed arterial occlusion. Improper or delayed treatment of neurovascular disorders can produce the same end result as mismanagement of occlusive arterial disease, namely, loss of use of the extremity. In vasospastic diseases which have their origin in emotional conflicts, such as acrocyanosis, Raynaud's syndrome and livedo reticularis, the original stress which caused the patient's illness may be perpetuated rather than relieved by a long course of therapy. Ebaugh has emphasized that in patients with emotional disorders misidentified and mistreated as organic disease, the tendency is not toward recovery but toward chronicity. Even if treatment is successful in abolishing the emotionally induced vasomotor disturbance, unless the emotional stress which produced it is resolved, conversion will merely be shifted to another organ system. This is exemplified by the Raynaud's patient who, after sympathec-

* Read at the Spring Session of the Eastern Section of the American Congress of Physical Medicine, Washington, D. C., April 29, 1950.

tomy of both upper and lower extremities, had incapacitating hyperhidrosis of the trunk and a peptic ulcer. Treatment of emotionally induced-vasospastic disorders, whether with autonomic blocking agents, sympathetomy or physical methods, is merely palliative. No degree of permanence can be expected unless concurrent psychotherapy is employed.

Treatment of peripheral vascular disease is aimed at (1) preventing tissue death by correcting the disproportion between the throttled blood supply and the demands of tissue metabolism, (2) conserving function in tissues not already irretrievably damaged and (3) rehabilitating the patient. It is obvious from a consideration of these aims that physical measures constitute a major portion of the basic framework of medical management. In all occlusive arterial diseases, whether functional or organic, blood flow to the extremity is diminished by varying degrees of vasoconstriction. In organic diseases like arteriosclerosis and thromboangiitis obliterans, vasoconstriction adds to the ischemia produced by structural changes that impede the flow of blood. In the functional arterial disorders such as Raynaud's syndrome, livedo reticularis, acrocyanosis and segmental arterial spasm, blood flow is obstructed by reversible narrowing of the arteries and arterioles. A similar mechanism operates to decrease blood flow in neurovascular disorders such as reflex dystrophies, anterior scalene syndrome and minor causalgia and in thrombophlebitis. The structural changes in arteriosclerosis obliterans and thromboangiitis obliterans are irreparable. We are largely dependent, therefore, on procedures that foster vasodilatation for increasing blood flow in both functional and organic circulatory disorders. Vasodilatation, with certain exceptions, insures optimal blood flow through available collateral channels. Better blood supply prevents the irreversible changes due to ischemia and increases the resistance of poorly nourished tissues to the effects of infection and injury. The simplest way to secure vasodilatation is to keep the patient warm. This can be done by having him wear warm clothing when he is up and about. For the bedridden patient it is accomplished by keeping the room temperature at 85 F. or by applying heat to the trunk or to uninvolved extremities. Heat pads, hot water bottles, electrically heated sleeves or radiant heat emanators are equally acceptable as long as they are properly shielded and as long as the heat is not applied to the affected extremity. Since reflex vasodilatation is dependent on the return of heated blood acting on the thermosensitive center in the hypothalamus, increase in blood flow will be roughly proportional to the degree of remote tissue heating. This is borne out by the plethysmographic studies by Goetz, Abramson and a number of other observers. Goetz showed that sustained increase in blood flow to the foot occurs only if the arm bath temperature is kept at 45 C. Richardson and his co-workers, in studying the effects of electromagnetic irradiation on blood flow, likewise found that increase in blood flow to an area depended on the degree of tissue heating. They noted that it was necessary to increase tissue temperature to levels between 42 and 44 C. in order to obtain a consistent increase in blood flow through the femoral artery. The danger of applying heat locally to an ischemic extremity should be more vigorously stressed to nurses, attendants and patients. We still see too many patients with necrotic toes resulting from ill advised use of heat on a relatively innocent lesion. We have in our practice avoided the use of any form of local heating. Even thermostatically controlled heat cradles will frequently exceed the desired levels. At times ischemic neuropathy and rest pain are intensified at cradle temperatures of 34 to 35 C. This would seem to indicate that in some patients even the generally approved cradle temperatures accelerate local tissue

metabolism beyond the capacity of the regional vessels to supply blood. In most cases we rely on conserving the temperature of the extremity by having the patient wear bed socks. Gangrenous extremities are wrapped in sterile cotton wool. Cradles are used only to eliminate the pressure of bed clothes. Local heat is frequently recommended during the acute phase of thrombophlebitis to foster vasodilation, relieve pain, hasten involution of the lesion and accelerate lymphatic flow. Warm, moist, full length packs are cumbersome and unless carefully attended to will actually chill and promote vasoconstriction. Other methods of heating, if used, must be carefuly regulated. Congested skin with retarded circulation, burns easily when exposed to bakers, heat pads and hot water bottles. Dramatic improvement has followed the use of autonomic blocking agents in many cases of iliofemoral thrombophlebitis. We prefer this form of therapy to sympathetic ganglion block with procaine because it eliminates the hazard of retroperitoneal hemorrhage in patients on anticoagulant therapy.

Heat

Heat in the form of hot sitz baths is recommended in the treatment of the postphlebitic syndrome. In our clinic, patients with chronic venous insufficiency are advised to take hot tub baths at 45 C. for 15 to 20 minutes twice daily. After the bath the patient reclines with the extremities elevated, wrapped in a warm blanket for 45 minutes. The patient is warned against walking or standing immediately after the bath. Failure to observe this precaution invariably increases the edema. This simple procedure in conjunction with elastic support of the leg has prevented massive swelling and skin changes in the majority of postphlebitic extremities.

Refrigeration

In sudden arterial occlusion Allen and Learmonth have advocated reduction of local catabolism by keeping the threatened part at 15 to 20 C. This is combined with the use of anticoagulants, analgesics and the induction of sleep to promote vasodilation. My experience with this form of therapy is limited. Ten of the 11 patients on whom it was used came to amputation. The other patient died. In fairness to the procedure, it should be mentioned that refrigeration was used as a last resort. In all instances pain was dramatically relieved. In the patient who died, aortic thrombosis had resulted in gangrene of all tissues distal to the pelvic brim. Thrombectomy and anticoagulants were used without success. Under refrigeration and antibiotic therapy the patient survived comfortably for three weeks. Death was caused by renal failure due to extension of the thrombus into the renal artery. On the basis of this experience, I should hesitate to recommend refrigeration as a means of preserving an extremity with severely decompensated blood supply. When amputation is contemplated and for patients who cannot be submitted to amputation, it is an excellent means of controlling pain and diminishing absorption of toxic products from an infected gangrenous extremity.

Rest, Position and Exercise

The erect position elicits reflex vasoconstriction of the lower extremity. This is shown by a fall in skin temperature and a reduction in blood flow. For patients with rest pain, ischemic neuropathy, ulceration or gangrene, therefore, activity and weight bearing are prohibited. Rest in bed with the head of the bed elevated from 10 to 12 inches will often diminish pain and accelerate healing. Prolonged complete inactivity should be avoided because

of increased susceptibility of patients with retarded circulation to phlebothrombosis and pulmonary embolism. Respiratory exercises and postural exercises by accelerating venous return are sound prophylactic measures. In addition to improving venous and lymphatic drainage during periods of elevation, the Buerger-Allen exercises produce mild vasodilatation. They also partially retard the atrophy resulting from prolonged tissue malnutrition and inactivity.

Sanders Oscillating Bed

The Sanders oscillating bed has essentially the same effect as postural exercises without expenditure of effort on the part of the patient. Like postural exercises, it appears to be more effective if used in conjunction with reflex vasodilatation. The adjustment of the bed for each patient is essential in order to avoid intensifying the ischemia and increasing the pain. I have used the oscillating bed with varying degrees of success for patients with ischemic neuropathy and gangrene that failed to respond to sympathectomy. Best results are obtained when the bed is kept in motion constantly day and night with intermissions only for meals and bed pan. On the whole, it is probably the most satisfactory of the mechanical means of treatment.

Physical Exercise

In patients with partially compensated occlusive arterial disease, properly regulated exercise produces mild vasodilatation and limits the degree of muscle atrophy. Those who show a paradoxical response to exercise should be advised against walking, even to the point of impending claudication. The patient should walk slowly and rest frequently. Protracted circulatory insufficiency resulting from sustained exercise can initiate rest pain, ischemic neuropathy and, in some instances, arterial thrombosis. Observations on over 200 patients with intermittent claudication associated with the paradoxical response to exercise strongly suggests that in many instances of intermittent claudication there is an absolute diminution in peripheral blood flow when the ischemic extremity is exercised.

In chronic venous insufficiency, prolonged exercise in the erect position will usually increase the swelling and produce aching discomfort in the leg. A short period of rest with the extremity elevated will usually control these manifestations. A snug-fitting elastic bandage should be worn whenever the patient is ambulatory.

Graded exercises instituted early in the posthyperemic phase of trench foot will frequently limit the incapacity due to this disorder. The discomfort following trench foot and immersion foot is due to the combined effects of the neurovascular injury and the generalized weakening of the supporting structures and intrinsic muscles of the foot. Inactivity and faulty gait, if not corrected early, will appreciably increase the disability.

Baths and Soaks

Moist applications to gangrenous areas and ulcers have been unsatisfactory because it is difficult to keep them warm without exposing the patient to the dangers of local heating. If not supervised closely, adjacent tissues become macerated and the extent of the lesion increases. I frequently use warm saline foot baths at temperatures of 35 to 38 C. for 15 minutes three times daily. This promotes drainage of collections of pus and softens adherent crusts. After infection is controlled, the ulcer is dusted with powdered

blood cells. If a clean dry eschar forms it is not disturbed unless infection recurs. Whirlpool baths at 35 to 38 C. are more effective than saline soaks in cleaning up dirty ulcer craters and improving drainage. Bierman has described a simple, relatively inexpensive modification of the whirlpool bath using oxygen and medicated with sulfathiazole which he has used successfully in treating refractory ulcers.

Contrast Baths

The increase in blood flow obtained with the cumbersome technic of the contrast bath is in no way superior and is shorter lasting than that obtained after ingestion of glycine powder or other protein feedings. I no longer prescribe contrast baths for patients with peripheral vascular disease.

Intermittent Venous Occlusion

Quantitative blood flow studies fail to support the view that intermittent venous occlusion results in measurable increase in circulation. Convincing evidence that stretching of the venocapillary bed occurs after prolonged treatment is also lacking. In spite of this absence of physiological evidence that the circulation is improved by this method, reports continue to appear claiming clinical improvement following its use. I have used intermittent venous occlusion on many patients with ischemic neuropathy, rest pain and impending gangrene, with unimpressive results.

Intermittent suction and pressure therapy similarly lacks experimental evidence to substantiate the view that it permanently increases the peripheral circulation in a limb with nonfunctioning blood vessels. I have never used this method of treatment. It is definitely contraindicated in the presence of infection, as it may result in spreading cellulitis and lymphangitis.

Mecholyl and Histamine Iontophoresis

Until priscoline hydrochloride became available, I employed mecholyl or histamine by ion transfer for the treatment of refractory ulcers due to acrosclerosis, Raynaud's syndrome, varicose veins and postphlebitic syndrome. These vasodilators increase blood flow through the skin and are extremely effective in accelerating healing of indolent lesions. During the past two years, however, we have obtained equally satisfactory results with priscoline hydrochloride parenterally and orally. For patients in whom undesirable side effects develop from this medication we have continued to use mecholyl and histamine by ion transfer for the treatment of these disorders.

Conclusions

If in judging a method one is guided by objective evidence of its efficacy, by its simplicity, by the permanence of response and by its cost to the patient, one is less likely to adopt undesirable forms of therapy.

Treatment of vascular disease has become increasingly efficacious because of the cooperation among internist, surgeon and physiatrist. Diseases are recognized earlier and treatment begun before irreversible damage leads to the loss of an extremity. The fundamental framework of treatment rests on a sound physiological basis. It is this rather than any specific method that has improved the prognosis for the patient with vascular disease.

Discussion of Dr. Prandoni's Paper

Dr. A. A. Martucci (Philadelphia): I enjoyed Dr. Prandoni's paper very much. It was very clear and quite conclusive, touching most of the highlights in his résumé. However, there are a few on which probably he and I don't agree.

As to the use of intermittent occlusion apparatus: We have had a good deal of experience with it for a good many years, and clinically it has shown some good results. Likewise with the negative and positive suction pressure boots; we again have used this type of apparatus in our departments over a good many years, and there is still a great demand for it. In fact, we are now looking around for extra pavex boots or other glass boots no longer manufactured. We do have a demand for this type of treatment. We believe we have saved a good many legs. Of course, one must develop a technic in the use of this type of apparatus. The earlier the patients are referred for treatment, the better will be the results. I quite agree with Dr. Prandoni that sometimes the results are miserable and these people go on to amputation in spite of anything we can do. That is not the fault of the apparatus which is used; it is probably the fault of late diagnosis and the condition of the patient.

Now, also, a few words about rehabilitation of a patient who has a peripheral vascular condition. A person otherwise healthy must not be allowed to become bed-happy. He must be treated as a whole, keeping future possibilities of self help, employability, etc., constantly in mind. The patient will begin to worry about his job, his family, his finances. It is his physician's duty to keep the patient in a good physical and mental condition. Convalescent therapy should be directed toward guidance and instruction. This should be coordinated with other existing services and agencies for the patient's welfare.

It is significant to understand the psychology of the patient suffering with peripheral vascular diseases. Too frequently the patients retire from work, or if the condition is arrested, perhaps undergoes amputation. These patients must be prepared for future eventualties. Their families and their communities through rehabilitation retraining and selective placement may help the patient again to take his place in industry. Early return to work prevents loss of skill and helps morale. It is the responsibility of social service workers to help the patient to discover the use of rehabilitation as offered by the community. Personal weaknesses, past missteps, confusion, irritability and psychologic helplessness must be corrected. The attitude of the family is important. Their relation to the patient may determine his ability to become rehabilitated. If the patient is assured of the family's loyalty, he will not feel isolated. For the patients who are undergoing treatment and have been hospitalized a possible discharge plan of rehabilitation with a definite objective is necessary. Rehabilitation of the patient with peripheral vascular disease, as in the treatment of any other diseases, should be directed to the maximum of fitness so that he may reach his full physical, social, emotional and vocational reestablishment in his community.

Dr. Elmer Elias (Trenton, N. J.): I want to take sides with Dr. Martucci in agreeing that we have found much success with the intermittent venous occluder and suction pressure boot. I would merely like to throw one little wrench in the wheel today. I think we are looking forward to rehabilitating patients who have reached a certain degree of disability in peripheral vascular disease. I think that we should go back and look at the conditions that are potentially going to develop. I think of the number of persons who have had trench feet, emersion feet and frozen feet during the past war. What are we doing so far as physical medicine is concerned in attempting to prewarn and pretreat the patients before symptoms develop? I think that something should be done and something understood concering nicotine. I feel like Carrie Nation carrying a cigaret butt in one hand and then throwing it away. I think we have a common understanding about nicotine. In our department of physical medicine, I discourage the use of tobacco in all cases, only to find out that the patients have been advised if they care to they may smoke from one to four cigarets a day; it is all right. I think we should have an understanding on that score.

I think some of the causes for lack of good results in the use of these various modalities come because of a lack of instructions to the patient on the smaller details concerning the proper fitting of shoes and socks and care of skin and body hygiene. I think that if more attention is given even there and if a patient is evaluated as to his disability, better results can be attained in the end.

MEDICAL NEWS

Honor Dr. Madge C. L. McGuinness

On Wednesday, March 7, the 30th anniversary and 29th annual dinner of the New York Society of Physical Medicine will be held at the New York Academy of Medicine, 103rd Street and 5th Avenue, New York, N. Y. On this occasion, the members of the New York Society of Physical Medicine will take the opportunity to honor its Secretary for many years, who has fought valiantly for the cause of physical medicine and for the welfare of her fellow citizens. Reservations for the dinner should be made before March 1, with Dr. Cassius Lopez de Victoria, 176 East 71st Street, New York 21, N. Y. The members of the dinner committee are Dr. de Victoria, chairman; Drs. William Bierman, Sidney Licht, Norman Titus and Jerome Weiss.

Personals

Frances Baker, M.D., San Mateo, Calif., has been unanimously voted by the Board of Governors of the Congress for the office of Secretary to serve out the unexpired term of the late Dr. Richard Kovács.

At the recent meeting of the American Society for Surgery of the Hand, held at the Palmer House, Chicago, Dr. **James G. Golseth** spoke on "Electromyograms."

Dr. **Albert A. Martucci** has been appointed to the Education and Vocational Guidance Board of the United Cerebral Palsy Associations, Inc.

Dr. **Louis B. Newman** gave an illustrated talk on "Recent Advances in Physical Medicine," before the Chicago Regional VA Society.

Dr. **William H. Schmidt** spoke on "Rehabilitation of disabilities due to vascular accidents" at the January meeting of the New Jersey Society of Physical Medicine.

Dr. **F. F. Schwartz** has been appointed assistant clinical professor in medicine at the Medical College of Alabama, Birmingham, Ala.

Massachusetts Builds New Chronic Disease Hospital

The State of Massachusetts has begun construction of a new Chronic Disease Hospital at Franklin Park, Jamaica Plain, on a site contributed by the City of Boston. The 12-story hospital will provide highly specialized facilities for diagnosing and treating disabling chronic diseases. It will also be a teaching center providing training in the latest scientific developments in the study of chronic diseases to medical students through its affiliation with Harvard, Tufts, and Boston University medical schools.

First of Medical Center's Buildings Readied for Dedication

As last patients arrived and settled into their new quarters, last minute changes and adjustments were completed for operation of the first new building of the New York University — Bellevue Medical Center, a two million dollar unit which was formally dedicated January 24th.

Representing the latest development in modern hospital planning, the new building will house the Medical Center's Institute of Physical Medicine and Rehabilitation. In it, the Institute's program of training disabled persons with the aim of returning them to normal living will be carried forward.

The new building, a long, four story building which comprises the northern wing of the new Medical Center, provides the most modern facilities in the nation for carrying forward a program of teaching, research and patient care in the field of physical medicine and rehabilitation. The entire development and construction program of the Medical Center is being carried forward at a cost of $32,000,000 on the four-block site from 30th street to 34th street, between First avenue and East River drive. This first new unit was completed within the estimated cost of $2,055,000.

Mr. Salmon pointed out during the final inspection tour that in case of atomic disaster the entire new building can be readily converted into general hospital facilities for a greatly increased number of beds, thus augmenting other hospital facilities in the city for emergency use . In addition, a section of the building's basement has been adapted as an effective bomb shelter for patients and staff.

Among unique and interesting features of the new building is the building's radiant heating system. This is contained in the ceilings and the surface of the plaster in the heating surface of the rooms. Another unusual feature was a "one piece swimming pool" manufactured at a cost of $100,000 and delivered as one piece of welded steel.

Also of interest are the soundproofed, stainless steel telephone booths, one of which is big enough to hold a patient lying on a stretcher and the other of which will hold a patient in a wheelchair. A special feature was an installation known as "rooms within rooms." Each of the two "rooms within rooms" stands on springs, is insulated and

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ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

JOHN STANLEY COULTER, M.D.

John Stanley Coulter has left a mark in the professional world that will stand for many years in tribute to him as a scholar and a teacher. Dr. Coulter accepted the challenge of Physical Medicine, and throughout his active professional life carried the torch in a world that was characterized by considerable darkness as far as Physical Medicine was concerned. Those of us who knew Dr. Coulter as our teacher are forever indebted to him for his spirit of kindly guidance and inspiring leadership.

His patients knew Dr. Coulter as an able counseler, a man of considerable patience and tact and a skillful physician. He saw not only the aching back, but the patient as a total person, and this in a period of our professional development when looking at the total person was not too frequent an occurrence. Dr. Coulter's ministry to his patients continued to benefit long after the effects of heat and massage had ceased.

The highest tribute that one person can pay to another is that that person was his friend. Friendship is a characteristic that Dr. Coulter had very well developed and used wisely. Those of us who had the privilege of being associated with Dr. Coulter remember him as a true, sincere and kindly friend. He was never too busy to write a helpful letter, he was never too busy to sit and counsel and give helpful advice, he was never too busy to exercise that rarest of all human virtues, namely, friendly interest in other people. Dr. Coulter's passing has left American medicine a worthy heritage and to those of us who were his friends the privilege of carrying on the work he so ably began.

THE JOHN S. COULTER MEMORIAL FUND

The resolution adopted by the Congress membership at its last meeting to establish the John S. Coulter Memorial Lecture at each annual session of the American Congress of Physical Medicine was heartily approved by many of us who knew Dr. Coulter as a doctor, a friend and a teacher. The preceding editorial expresses well the feeling of many members of the Congress and especially those of us who were students under him.

Dr. Harry E. Mock in writing of Dr. Coulter in the Proceedings of the Institute of Medicine of Chicago said, "Those of us who knew John Stanley Coulter well, who worked with him throughout the years, fully appreciate his

achievements, his right to leadership, and how well he deserves the honors bestowed upon him. He received these without the least sign of ostentation. He remained always the simple, friendly, always helpful, very human individual whom all men, knowing him well, loved and respected."

At this time it is not necessary again to review his many achievements in helping develop the specialty of physical medicine and rehabilitation.

In establishing this fund the membership did not define in detail the amount of money to be obtained nor how it should be dispersed. It is the feeling of the committee delegated with the responsibility of establishing this fund that if adequate money can be accumulated, the earnings each year might well pay an honorarium for the person selected to give the lecture annually. There are many new members in the Congress who were not privileged to know Dr. Coulter personally but they have on many occasions, no doubt, referred to his writings and because of his many contributions, will want to help build this fund and advance the specialty which they are following.

The committee calls upon the membership at this time to send their contributions to the Chicago office so that this fund may grow and we may have the first John S. Coulter Memorial Lecture at the Congress meeting in September of this year.

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Philadelphia, June 16 and 17, 1951. The final date for filing applications is March 31, 1951. Requests for applications for eligibility to the examinations should be mailed to the Secretary, Dr. Robert L. Bennett, 30 North Michigan Avenue, Chicago 2, Illinois.

Medical News
(Continued from page 106)

soundproofed and has no rigid connection with the room in which it stands. The rooms within rooms are used to test persons whose powers of speech have been lost or damaged and to record their improvement.

The new Institute has a capacity of 100 inpatients and 150 outpatients a day.

Announcement of Fellowships by the National Paraplegia Foundation

Fellowships for research in basic and medical sciences bearing on the problems of paraplegia have been established by the National Paraplegia Foundation. They are open to residents of the United States or Canada who wish to pursue research on spinal cord function or diseases and on problems related to complications of spinal cord injury. Candidates for these fellowships will be accepted in each of the following categories: (a) Postgraduate Medical, open to promising young investigators with M.D. degree for prosecution of research; (b) Pre- and post-doctorate basic science, open to students at a graduate level.

Candidates may obtain application forms for these fellowships from the Chairman of the Medical Advisory Committee. Address inquiries to Dr. L. W. Freeman, Chairman, Medical Advisory Committee, National Paraplegia Foundation, 1040 W. Michigan Street, Indianpolis 7, Indiana.

International Poliomyelitis Conference

The Second International Poliomyelitis Conference has been scheduled for September 3-7, 1951, at the Medicinsk-Anatomisk Institute of the University of Copenhagen, in Copenhagen, Denmark, officials of the International Poliomyelitis Conference have announced.

Sponsors of the meeting are the National Foundation for Infantile Paralysis of the United States and the Danish National Association for Infantile Paralysis. Presiding President of the Conference is Professor Neils Bohr of Copenhagen.

The tentative program of the five day meeting includes 32 papers and discussions on the general headings: "Virus and Its Interaction with the Host Cell"; "Pathology and Pathophysiology of Poliomyelitis"; "The Coxsackie Group of the Viruses"; "Differential Diagnosis in Acute Poliomyelitis"; "Treatment of Poliomyelitis"; "Immunity and Resistance in Poliomyelitis and Other Virus Infections," and "Ecology of Poliomyelitis."

Papers will be delivered in English, French, German or Spanish. Arrangements are being made for simultaneous interpretations, using IBM equipment, such as employed by the United Nations.

The Danish Royal Ministry for Foreign Affairs is extending invitations to 60 nations to send official delegates to the Conference. These delegates will report on poliomyelitis in their respective countries. Physicians and scientists interested in poliomyelitis are invited to attend. The Conference will invite representatives of societies and organizations interested in research and treatment of virus diseases.

Transportation and currency arrangements are being facilitated by Thomas Cook & Son, Wagon-Lits-Cook, and the American Express Company. Conference officials announced that the Swedish-American Lines are making available the MS STOCKHOLM, which is scheduled to leave New York on August 25th, and to arrive at Copenhagen on September 2nd.

Requests for hotel accommodations and information concerning the Conference may be obtained from the Secretariate of the Second International Poliomyelitis Conference, Statens Seruminstitut, 80 Amager Boulevard, Copenhagen s, Denmark. The telegraphic address is POLIOCON, COPENHAGEN.

Amputee Conference

The fifth annual amputee conference will be held April 5, 6 and 7, 1951, at the Kessler Institute for Rehabilitation, Pleasant Valley Way, West Orange, N. J. The lectures and demonstrations will be given by staff and visiting specialists. The conference is open to physicians, limb makers, therapists and other rehabilitation personnel. The registration fee is $5.00; the registrar, Mrs. Noel Dousman. The detail of the schedule follows:

Thursday, April 5 — Upper Extremity

9:00- 9:15 A.M.	Registration
9:15-10:15 A.M.	Introduction to Amputee Problem
10:15-10:45 A.M.	Basic Surgery—Upper Extremity
11:00-12:00 A.M.	Mechanical Prosthesis
12:00- 1:00 P.M.	Luncheon
1:00- 1:30 P.M.	Cineplasty and Cineplastic Prosthesis
1:30- 1:45 P.M.	Preprosthetic Training — Upper Extremity Amputation — Film
2:00- 3:00 P.M.	Training Technics
3:00- 4:30 P.M.	Clinic—Arm Amputees

Friday, April 6 — Lower Extremity

9:00-10:00 A.M.	Basic Surgery—Above Knee
10:00-10:30 A.M.	Anatomy of Lower Extremity
10:45-11:00 A.M.	Fundamentals of Locomotion
11:00-12:00 A.M.	Preprosthetic Care — Bandaging Bed Posture
12:00- 1:00 P.M.	Luncheon
1:00- 2:15 P.M.	Prothesis — Selection and Fit Conventional A. K. Prothesis
2:30- 3:45 P.M.	Training Principles and Crutch Walking
4:00- 4:30 P.M.	Discussion of Surgical and Prosthetic Aspects — or Clinic-Lower Extremity

Saturday, April 7 — Lower Extremity

9:00- 9:45 A.M.	Basic Surgery—Below Knee
9:45-10:15 A.M.	Conventional B. K. Prosthesis
11:00-12:30 P.M.	Suction Socket Prosthesis
12:30- 1:30 P.M.	Luncheon
1:30- 2:00 P.M.	Tilting Table Prosthesis
2:00- 3:00 P.M.	Demonstration of Training Technics A. K. and B. K. Amputees
3:15- 4:00 P.M.	Round Table Discussion of Surgical, Prosthetic and Training Aspects

Cerebral Palsy Clinic

The Cerebral Palsy Clinic of the Medical Society of Milwaukee County opened in October in offices in the Goodwill Industries Building in Milwaukee. The medical director is Dr. Raymond C. Waisman. An occupational and a physical therapist are full time employees.

28th Annual Session American Physical Therapy Association

The 28th Annual Conference of the American Physical Therapy Association will be held at Hotel Colorado, Glenwood Springs, Colorado, June 17-22, 1951.

Lectures and clinical workshops will be devoted to the following subjects: Lower Extremity Amputees, Chest Disabilities, Physical Therapy in Neuropsychiatric Conditions, Electrical Stimulation and Testing.

National Conference on Chronic Disease

The National Conference on Chronic Disease will be held in Chicago at the Edgewater Beach Hotel, March 12, 13 and 14, 1951. Representatives of over 20 national organizations are participating in the pre-conference preparation of statements, including the following: cardio-vascular diseases, Dr. John W. Ferree, and Dr. C. J. Van Slyke; arthritis and rheumatism, Dr. Hans Waine; poliomyelitis, Dr. Hart E. Van Riper, and Dr. Victor Haas; multiple sclerosis, Dr. George Schumacher, and Dr. Leonard Kurland; cerebral palsy, Dr. Meyer Perlstein.

Newly Registered Therapists

December 28, 1950

Caplis, Sr. Bonaventure, 2568 W. Hebert St., St. Louis 7, Mo.

Hallas, Evelyn M., 1152 Maplewood Ave., Ambridge, Pa.

Sunetaro, Cora, 1626½ Magnolia, Los Angeles 6, Calif.

January 15, 1951

Atwood, Bernidine, Star Route No. 3, Bath, Me.

Bailey, Paul T., Gonzales Warm Springs Foundation, Gonzales, Tex.

Colvin, N. Genevieve, 1343 S. 32nd St., Philadelphia, Pa.

Dreher, Harriet A., 2300 Lincoln Park West, Chicago 14, Ill.

Holmes, Robert C., Route No. 1, Electra, Tex.

Rugaart, John, Jr., 2233 Miles Ave., Kalamazoo, Mich.

Sanders, Betty Jean, Gonzales Warm Springs Foundation, Gonzales, Tex.

Salway, Gladdwynn P., 1924 Columbus Ave., Minneapolis, Minn.

January 16, 1951

Alway, Dillard, 1943 Elmwood, Stockton, Calif.

Aldrich, Barbara, 4604 Seneca St., Buffalo 24, N. Y.

Anderson, Eunice, Valentine, Ariz.

Anniehs, Hedwig, 100 Congress St., Pasadena, Calif.

Bair, Betty, 510 E. Clark, Livingston, Mont.

Boismier, Oscar, 1713½ New Jersey, Los Angeles 33, Calif.

Butcher, Robert, 156 School St., Daly City, Calif.

Cochrane, John, 1715 21st St., Galveston, Tex.

Davis, Henry, 1429 Oak St., San Francisco 17, Calif.

Dillon, William, 1202 Via Portola, Los Angeles 33, Calif.

Fields, Ruby, 1470 Polk St., Eugene, Ore.

Gregerson, Grant, 1256 Yale Ave., Salt Lake City, Utah.

Guldjord, Dolores, 7749 32nd Ave., N. W., Seattle 7, Wash.

Heidinger, Clifford, 25 Oakdale Rd., Rainbow Gardens, Denville, N. J.

Houdlette, Priscilla, Foundation Apts. B-5, Galveston, Tex.

Keropian, Michael, 2832 California St., San Francisco, Calif.

Lane, Rothman, P. O. Box 484, San Bernardino, Calif.

Linquist, Jeanne, 19 Sycamore Ave., Jamestown, N. Y.

Lyon, Joetta, 542 Webford Ave., Des Plaines, Ill.

Martin, Ronald, 312 N. Boyle Ave., Los Angeles 33, Calif.

Monteforte, Frank, 464 West End Ave., Long Branch, N. J.

Orser, Melvin, 312 N. Boyle Ave., Los Angeles 33, Calif.

Oswald, Robert, 726 Glenwood Ave., Buffalo, 11, N. Y.

Pratt, Nancy, 538 Churchill Rd., West Englewood, N. J.

Ritz, Emil, 312 N. Boyle Ave., Los Angeles 33, Calif.

Roberts, George, 312 N. Boyle Ave., Los Angeles 33, Calif.

Robinson, George, 312 N. Boyle Ave., Los Angeles 33, Calif.

Schleifer, Stanley, 1732 Autumn Ave., Memphis, Tenn.

Schuch, Charles, Base Line Rd., Grand Island, N. Y.

Smith, Cynthia, 14 Rockridge Rd., Wellesley Hills 82, Mass.

Tanaka, Shigeko Christine, 14421 Chatsworth Dr., San Fernando, Calif.

Thorpe, Clifford, 742½ N. Verdugo Blvd., Glendale 6, Calif.

Williams, Alla Gene, 418 Pecan Ave., Philadelphia, Miss.

January 18, 1951

Botek, Jean, 1040 W. 43rd St., Los Angeles 37, Calif.

Caraway, Ruth I., 1083 East Ave., S. E., Warren, Ohio.

Gibson, Mrs. Harriet W., 3622 17th St., San Francisco, Calif.

King, Lawrence J., 1434 S. 35th St., Kansas City 6, Kan.
King, Thomas B., 909 S. Ash Ave., Inglewood, Calif.
Koerner, Frances, 1024 N. Oxford Ave., Los Angeles 37, Calif.
Leaman, Mrs. Irene M., 218 E. Frederick St., Lancaster, Pa.
Lynn, Mrs. Eileen, State Dept. Public Health, Division Public Health Nursing, Capitol Bldg., Cheyenne, Wyo.
Martin, Katherine J., 948 Fillmore St., Philadelphia 24, Pa.
Miller, Frederic E., 4738 11th Ave., Los Angeles 43, Calif.
Murphy, Mildred T., 1301 Lyon St., Flint 4, Mich.
Peterson, Jack B., 8901 Ashcroft Ave., Los Angeles 48, Calif.
Stavish, Gerard E., 1527-A Marcelina, Terrace, Calif.
Travis, Irvin F., c/o Piestrup, 2211 Pier Ave., Santa Monica, Calif.
Wallace, Mrs. Margaret M., 615 Normandie So., Los Angeles 5, Calif.

January 24, 1951

Bachmann, Evelyn E., 1502 State Street, E. St. Louis, Ill.
Bell, Nancy Jane, 23 Clark Street, Pleasantville, N. Y.
Holley, Lydia Say, N. C. Orthopedic Hospital, Gastonia, N. C.
Lampton, Edward W., 311 Fayette Street, Charleston, W. Va.
Morrison, Harriett E., 224 Edgedale Drive, High Point, N. C.
Perkins, Lois C., 436 Oakwood Ave., East Aurora, N. Y.
Snowberger, Campbell, Box 333, Waynesboro, Pa.
Steele, C. Margaret, 505 Hart Road, Lexington, Ky.
Wilson, Alberta B., Route 2, Fayetteville, Tenn.

January 31, 1951

Bacot, Dorothy E., 64 W. 133rd St., Apt. 12A, New York 30, N. Y.
Briccetti, Frederick J., Hanover Road, Yorktown Heights, N. Y.
Hileman, Robert R., 1217 W. 3rd St., Cameron, Mo.
Obrasajko, Charles, 645 S. 67th St., Milwaukee 14, Wis.
Pfeiffer, Violet R., 816 Alabama St., San Francisco, Calif.
Young, Joan M., Westphalia, Kan.

February 1, 1951

Barati, Margaret E., Box 245, Broughton, Pa.
Bosch, Marta B., Box 396, Cayey, P. R.
Burmeister, Charles W., 1711 Market St., Ashland, Pa.
Champe, Ruth V., 263 Coram Ave., Shelton, Conn.
Cooper, Marian V., 215-51 Murdock Ave., Queens Village, N. Y.
Cozzie, Patrick, L., 320 Berlin Rd., Huron, Ohio.
Dean, Harry E., 1304 Frankstown Rd., Pittsburgh, Pa.
Eisenlohr, Elizabeth R., 505 Shoemaker Ave., Jenkintown, Pa.
Eldridge, Paula J., 165 N. Dithridge St., Pittsburgh 13, Pa.
Ferguson, Barbara E., 65 State St., Windsor, Conn.
Geisler, Teresa M., 1206 Linden Pl., Pittsburgh, Pa.
Herrington, James, Weirton Heights, Weirton, West Va.
Kaufman, Susan, 42-02 Layton St., Elmhurst, L. I., N. Y.
McCracken, William J., 3224 Fuller St., Philadelphia, 36, Pa.
Manchin, Joseph M., Farmington, West Va.
Mitchell, Pauline J., 4217 N. Visscher St, Tacoma 7, Wash.
Nunez, Angeles A., BN No. 4, San Fernando St., Puerto Nuevo, P. R.
Randolph, Eugene V., 833 Xenia Ave., Dayton 10, Ohio.
Raymer, Sara Mae, 363 W. 5th St., Lewistown, Pa.
Scholtz, Elizabeth A., 312 First Ave., S. E., Watertown, S. D.
Schulenberg, Martha J., 315 Afton Ave., Akron, Ohio.
Skrabut, Dorothy H., R. D. No. 2, Box 37, Sewickley, Pa.
Sotomayor, Iris J., Jose de Diego 13, Box 129, Rio Piedras, P. R.
Stanton, Fay A., 220 Lelia St., Johnstown, Pa.

Correction

Due to an error on the part of the Birtcher Corporation the wrong illustration appeared in their advertisement in the January issue of the ARCHIVES. The Birtcher Corporation wishes to state that the photograph that was shown was of the Bandmaster Diathermy. The illustration should have been of the Birtcher Challenger Diathermy which differs considerably in appearance.

BOOK REVIEWS

A TEXTBOOK OF NEUROPATHOLOGY. WITH CLINICAL, ANATOMICAL AND TECHNICAL SUPPLEMENTS. By *Ben W. Lichtenstein*, M.D., Associate Professor of Neurology, University of Illinois College of Medicine; State Neuropathologist, Illinois Neuropsychiatric Institute; Attending Neurologist Cook County Hospital; Professor of Neurology, the Cook County Graduate School of Medicine; Attending Neuropsychiatrist, Mount Sinai Hospital, Chicago. Cloth. Pp. 474 with illustrations. Price, $9.50. W. B. Saunders Company. 218 Washington Square, Philadelphia 5, 1949.

A good founding in neuropathology is essential for the specialists in neurology, psychiatry, neurosurgery and physical medicine. This book should appeal to those training in these fields as well as to medical students. Although the orientation of the text is on anatomy and pathogenesis, brief clinical descriptions of each disease are included. The illustrations are uniformly excellent and the print attractive. An unusual feature is a clinical supplement containing thumbnail sketches of 114 syndromes and symptom complexes together with selected references. For the sake of completeness a chapter on laboratory technic is appended. This is a valuable new addition to the texts on this subject which is particularly useful for the clinician and postgraduate student.

THE PHYSIOLOGY AND PATHOLOGY OF EXPOSURE TO STRESS. A TREATISE BASED ON THE CONCEPTS OF THE GENERAL-ADAPTATION-SYNDROME AND THE DISEASES OF ADAPTATION. By *Hans Selye*, M.D., Ph.D. (Prague), D.S. (McGill), F.R.S. (Canada), Professor and Director of the Institut de Medicine et de Chirurgie experimentales Universite de Montreal. Cloth. Price, $14.00. Pp. 822 with Reference supplement of 203 R pages. Acta, Inc., Medical Publishers, Montreal, Canada, 1950.

The principle of the general-adaptation-Syndrome is one of the monumental, modern conceptions of disease and the body reactions. When the author first presented his theories years ago, it received little attention, but today, due to his efforts and perseverance, and the accumulation of additional information, it is better understood and more widely accepted. Not everyone will fully agree with his concept of the general-adaptation-Syndrome as the explanation of life's reaction and the causation of disorder processes in the human. Even the author would not anticipate complete agreement with his ideas — he himself best states this in the final remarks of the book as follows, "up to the month of May, nineteen hundred and fifty, this is all I have learned that deserves to be recounted about the general-adaptation-Syndrome and the Diseases of Adaptation. I rather suspect there will be much more to tell next year — and the year after that; while part of what I think I know I shall believe no longer." Even if only a fraction is finally accepted, he will be entitled to fame that is reserved for the great.

The book may be roughly divided into two sections. The first section on the General Physiology and Pathology of Systemic Stress which analyzes in detail the systemic reactions that result from external stimuli of many types and also the changes in metabolic functions which are caused by the agents which evoke the alarm reaction. The second section is entitled "Morphologic and Functional Changes in Various Organs." Each system is considered as to the role the stress factor may be responsible for specific reactions that occur in normal and abnormal life.

This latest book of Dr. Selye's brings up to date his principles. It is a tremendous piece of work such as only an individual with the indefatigable energy of Dr. Selye could produce. This is the type of work that will interest the research investigators in all branches of biology and any mature graduate student in every phase of medicine.

UROLOGICAL ASPECTS OF SPINAL CORD INJURIES. By *George C. Prather*, M.D., Department of Genito-Urinary Surgery, Harvard Medical School, Boston. Cloth. Pp. 146. Price, $3.50. Charles C Thomas, Publisher, 301-327 East Lawrence Ave., Springfield, Ill., 1949.

This timely monograph deals with a subject of extreme importance, especially in view of the recent flood of casualties from the Korean battle front. Experience gained in World War II, observations of bladder function in experimental animals, and an enormous wealth of clinical experience gathered over the past two decades have done much to improve the outlook for those suffering from urinary tract dysfunction due to spinal cord injury.

Anatomical and neurophysiological aspects of the urinary tract are dealt with concisely but thoroughly, helping to form a better background for understanding the clinical course of this disorder and the rationale of treatment.

The author adequately covers such vitally important subjects as the examination and care of the bladder, changes in the upper urinary tract and the sexual organs after spinal cord injury. Genito-urinary complications are discussed with special reference to calculi (renal, urethral and bladder) and infection. Impotency, fistula, abscesses of the prostate and urethra receive less, but adequate, attention.

The discussion is concluded with a consideration of the methods of treatment and a summary of World War I and World War II experiences with these patients.

This 118-page monograph is well illustrated with 43 graphs, charts and photographs. It condenses a difficult subject into a few pages of easily read text, and should be welcomed by neurosurgeons and others entrusted with the care of this type of patient.

LABORATORY INSTRUCTIONS IN ANIMAL BIOLOGY. By *John B. Parker* and *John J. Clarke*. The Catholic University of America, Washington, D. C. Third edition. Paper back. Price, $1.50. Pp. 110. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo., 1950.

This laboratory manual entitled "Laboratory Instructions in Animal Biology" was formerly Part I of the authors' manual "Laboratory Instructions in General Biology." This new method of presentation was made at the request of schools using the authors' manual, as the first year in biology is confined to either plant, or animal life—but not both. Thus the student is not required to purchase both unless necessary.

This is the third edition of the manual and this fact alone attests to the value of the authors' work. It is well planned and is to be used in conjunction with any standard textbook of biology. The manual guides the selection of the textbook topic to be studied.

Because the beginning student experiences some difficulties in learning the use and manipulation of the compound microcsope, the authors have wisely placed such subjects as mitosis, reduction division, spermatogenesis and oogenesis at the end of Animal Biology. Laboratory instructions for dissection of the spiny dogfish has been added as an appendix.

This is an excellent manual for beginners in biology but of little interest to the physiatrist or physical therapist.

PRINCIPLES OF INTERNAL MEDICINE. *T. R. Harrison*, Editor-in-Chief, *Paul B. Beeson, William H. Resnik, George W. Thorn* and *M. M. Wintrobe*, Editors. Cloth. Price, $12.00. Pp. 1590, with 245 illustrations. The Blakiston Company, 1012 Walnut St., Philadelphia 5, 1950.

This book follows the trend in clinical teaching in that the basic mechanisms of disease are presented rather than the customary recitation of specific diseases. The disorders in the various structures are integrated with the pre-clinical sciences and with internal medicine.

The book is divided into seven parts. Part I on the Cardinal Manifestations of Disease includes discussions of pain, weakness, shortness of breath, disturbances of circulation, indigestion, alterations in weight and anemia. Part II on Physiologic Considerations contains sections on inheritance, aging, neoplastic diseases, intermediary metabolism, normal emotional development and others. The part deals with certain fundamentl principles which afford a better approach to the mechanisms of diabetes, the various endocrine disorders and the deficiency diseases. Part III discusses Reactions to Stress and Antigenic Substances which is an entirely new concept. Part IV entitled "Metabolic and Endocrine Disorders" covers the nutritional disturbances and is edited by Dr. George W. Thorn. Part V — Disorders Due to Chemical and Physical Agents. Part VI — Diseases Due to Biological Agents thoroughly considers the various infectious diseases in the more conventional manner. Part VII covers the Diseases of the Organ Systems.

This is a major work in medical literature. Five editors and 48 contributing authors produced the book. They were selected because of their knowledge of their subject and their ability to present it concisely and intelligently. This functional approach to the understanding and management of diseases will be most helpful to students and physicians.

BONE AND JOINT DISEASES. Pathology Correlated With Roentgenological and Clinical Features. By *J. Vernon Luck*, M.S. (Ortho.), M.D., F.A.C.S., F.I.C.S. Assistant Clinical Professor of Orthopedic Surgery, University of Southern California. Senior Attending Physician, Department of Orthopedic Surgery, and Consultant in Orthopedic Pathology, Los Angeles County Hospital. Member, Subcommittee in Orthopedic Surgery, National Research Council. Member, Board of Associate Editors, *Journal of Bone and Joint Surgery*. Fabrikoid. Price, $16.50. Pp. 640, with 703 illustrations, 21 illustrations in full color. Charles C Thomas, Publisher, 301-327 E. Lawrence Avenue, Springfield, Ill., 1950.

The author in his preface states that this book required ten years to produce. The time was justified for the final product is a new and unusual book on bone and joint diseases in which the author has successfully correlated the pathological anatomy with the roentgenological and clinical findings. This approach to the subject is unique and aids in a better understanding of the changes that occur in the bones and joints due to various diseases and disorders. Judicious use of histological sections helps demonstrate these changes.

An opening chapter on the normal skeletal system considers the anatomy, both gross and histological, the physiology, the embryology and chemistry of this system in a concise and instructive manner. The chapters on the tumors of the bones and joints are complete. This difficult subject is presented in a very satisfactory way and brings orderliness rather than the usual confusion. There are other chapters on infections, fractures with no attempt to consider them individually, arthritis, neurogenic and metabolic influences, the bone changes produced by lead, bismuth, phosphorus, radium and fluorine, extraskeletal calcification and others.

A vast amount of material has been accumulated in this book and has been presented in a clear and scholarly fashion. The illustrations are numerous and exceptionally well reproduced, this includes the microscopic sections many of which are in color, the gross specimens and the roentgenograms.

This work should be particularly valuable to the orthopedist, pathologist, roentgenologist and internist, and all others who are interested in any way with bone and joint pathology. As a textbook on the osseous system, it is indispensable.

LABORATORY INSTRUCTIONS IN PLANT BIOLOGY. By *John B. Parker* and *John J. Clarke*. The Catholic University of America, Washington, D. C. Third edition. Paper back. Price, $1.25. Pp. 80. Illustrated with line drawings. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo., 1950.

This manual was formerly Part II of the authors "Laboratory Instructions in General Biology." This change was made by request of those schools using the previous manual.

The exercises presented are to enable a student to acquire a knowledge of the fundamental processes in the life activities prevalent in the plant world and to bring to his attention for study the various types of plants and their structures by means of which these life activities are carried out.

It is supposed to be coordinated with any standard textbook of botany. The exercises are so presented that it is to determine the selection of the topic to be studied in the textbook. The sequence in which the subject matter of the course should be presented to the student should be determined by the manual. The editors have presented an excellent and deservedly popular exercise manual. While the manual is a splendid one for beginners in botany it will be of little interest to the physiatrist or physical therapist.

HEALTH INSTRUCTION YEARBOOK 1950. Compiled by *Oliver E. Byrd*, Ed.D., M.D., F.A.P.H.A. Professor of Health Education, and Director, Department of Hygiene, School of Education Stanford University. Foreword by *Jesse Feiring Williams*, M.D., Sc.D. Professor Emeritus, Teachers College, Columbia University. Cloth. Price, $3.50. Pp. 270. Stanford University Press, Stanford, California, 1950.

This eighth volume follows the pattern of the previous years, presenting new material drawn from the twelve-month interval between publications. Two hundred and fifty-five articles were selected and digested from 1,628 scientific reports. Ninety-two different sources are represented in the 1950 Year Book.

At the beginning of each chapter he briefly summarizes the developments to be treated in that chapter. Then he expends the condensation. And finally for the guidance of those who wish to pursue a special research further, he provides a complete bibliography.

Covered in a style stripped of difficult medical terminology are such topics as excretion and health, mental health and disease, heredity and eugenics, infection and immunity, chronic and degenerative disorders and school health.

After scanning the Health Instruction Year Book 1950, one should no longer question what to do in an atomic attack, whether carbon monoxide damages the brain, whether base coats harm finger nails and many others.

THE VITAMINS IN MEDICAL PRACTICE. *J. Shafar*, M.D., M.R.C.P., D.P.H. Cloth. Price, $4.50. Pp. 383. Staples Press, Inc., 70 E. 45th St., New York 17, 1950.

This work is concerned with the study of vitamins in their application to medical practice. Following an introductory chapter, the first part comprises a description of the individual vitamins. The second is concerned with the accepted major clinical syndromes referable to body depletion of one or more of the vitamins. The third part considers the individual systems in relation to the vitamin status of the body, and the value of vitamins in affections which are not attributable to their deficiency is carefully assessed. The problems peculiar to pregnancy, infancy and childhood are dealt with in this section.

The author in his introduction stresses the importance that the indiscriminate consumption of synthetic vitamin preparations because of their supposed "tonic" effects is greatly to be deprecated. There are 1684 references to document the work and this alone should assist the physician who is confused as to the respective value and dosage because so many vitamin preparations have been introduced on the market. In the addendum there is given a short discussion on Vitamin B_{12} and Vitamin P. Throughout the book, the results of animal experiments have been introduced as they relate to the particular subject.

CORONARY CIRCULATION IN HEALTH AND DISEASE. By *Donald E. Gregg*, M.S., Ph.D., M.D., Chief Research Physician, Medical Department, Field Research Laboratory, Fort Knox, Kentucky. Cloth. $4.50. Pp. 227, with 73 illustrations. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1950.

This monograph makes available the contemporary knowledge on the most vital section of the circulatory system, namely the coronary circulation. When it is appreciated that "at least two-thirds of all heart disease and heart failure arise from a relative or absolute failure of this vascular tree" any efforts that will aid in a better understanding or stimulate further investigation of the problems should be encouraged.

This volume admirably correlates the clinical features with the experimental approaches to the study of the coronary circulation both in the normal and

in the pathological. The following chapter headings demonstrate the author's method of presentation: Experimental Approaches to the Coronary Circulation Preparations, Experimental Approaches to the Coronary Flow, Distribution of Coronary Blood Flow—Phasic Flow Curves, Determinants of Coronary Blood Flow and Their Evaluation, Metabolism and Work and Coronary Circulation in Heart Disease and Heart Failure.

This book should be valuable to internists, particularly cardiologists, physiologists and pathologists.

RECENT PROGRESS IN HORMONE RESEARCH: THE PROCEEDINGS OF THE LAURENTIAN HORMONE CONFERENCE. Volume V. Edited by *Gregory Pincus*. Committee on Arrangements: R. W. Bates, and others. Cloth. Price, $8.80. Pp. 537 with illustrations. Academic Press, Inc., 125 E. 23rd St., New York 10, 1950.

This book is the report from the sixth annual meeting of the Laurentian Hormone Conference which is sponsored by the leading pharmaceutical companies. It includes fourteen papers and the unrestricted discussion which followed their presentation.

The six sections are divided as follows — Section I — Humoral Mediators in Nervous Transmission in which the first paper presents the experimental information supporting the effect of epinephrine and arternol on the humoral theory. The second paper brings up to date the material about the acetylcholine system in neural function. Section II contains four papers on Ovarian Physiology and Function. Section III on Pituitary Physiology and Function with the first paper on the relationship between the pituitary and gonadal systems, and the second paper on the factors controlling the pituitary gland; both the posterior and the anterior lobes. The effect of plant extracts particularly lithosperm on the action of some of the anterior lobe hormones is brought out. Section IV is on the Chemistry and Physiology of the Sex Hormones. Section V contains two papers on Hormones and Tumors. The first paper is the result of the work at the Bar Harbor laboratory in which they showed how it is possible to produce different types of adrenal cortical carcinoma which are active secreting areas for sex hormones. The second paper is entitled "the Virilizing Syndrome in Man." The last Section is the Mechanisms of Hormone Action with one paper concerning the biological and chemical nature of the hyperglycemic factor of the pancreas and the other paper on the hormone-enzyme relationships elaborating on the changes in the tissue enzymes in normal and hormone-deficient animals, and on the effect of estrogens and related compounds on the oxidative enzymes.

This is a timely contribution to this very important subject. The knowledge and function of the endocrine glands and their relationship to the hormones is changing so rapidly that it is difficult to keep abreast of the work. This book brings up the latest developments in research as conducted in the most outstanding laboratories in this country and the ideas and theories of the leading authorities.

ACOUSTIC MEASUREMENTS. By *Leo L. Beranek*, F.D., D.Sc. (Hon.), Associate Professor of Communication Engineering and Technical, Massachusetts Institute of Technology, Cambridge, Massachusetts. Prepared under the auspices of the Office of Naval Research, Navy Department, Washington, D. C. Cloth. Price, $7.00. Pp. 914 with 519 illustrations. John Wiley & Sons, Incorporated, 440 Fourth Avenue, New York, 1949.

This book is one of the most needed books that ever could have been written in the field of acoustics. Together with the book by Wever on theory of hearing, also published by Wiley and reviewed in the ARCHIVES, it covers the entire field of physiological acoustics.

The present book deals with all problems of acoustical measurement. It discusses general distribution of sound, measurement of frequency acoustic impedance, and analysis of sound waves, microphones and ear loudspeakers, the components of entire communication systems, and the measurement of acoustical material, and a host of other acoustical measurement problems. The audiometer, hearing aids and articulation test methods are discussed in detail.

This book is not a textbook on sound. It is a textbook on the measurement of sound and sound systems; and, as such, there isn't a single item in the field that has not been covered.

For those of us in Physical Medicine who are interested in hearing problems or in the problems of hearing aids and audiometers, this book is an absolute must. In the entire field of acoustics, this book will undoubtedly become one of the most read standard works in the literature.

PSYCHOSOMATIC MEDICINE: ITS PRINCIPLES AND APPLICATIONS. By *Franz Alexander*, M.D., Director, Chicago Institute for Psychoanalysis; Clinical Professor of Psychiatry, University of Illinois. With a chapter on *The Functions of the Sexual Apparatus and Their Disturbances* by *Therese Benedek*, M.D., Member of staff, Chicago Institute for Psychoanalysis. Cloth. Pp. 300. Price, $4.50. W. W. Norton & Company, Inc., 101 Fifth Avenue, New York 3, 1950.

Psychosomatic is a term which has been almost avidly adopted by physicians and patients alike as it places a stamp of respectability on psychic processes in relation to bodily symptoms. This is probably all to the good as it makes it easier to accept therapy directed toward psychological functions. It is likely, however, that very few using this term have any specific concept of the psychodynamic mechanisms involved. This volume presents a concise description of these mechanisms based on psychoanalytical concepts. Case

histories are skilfully interwoven so that the physician not familiar with psychoanalytical dogma may understand the interpretations.

The introductory chapters give a summary of modern psychiatry and in particular the psychoanalytical approach. Symptoms in reference to the different systems of the body are then discussed in separate chapters ending with a final chapter on sexual functions.

This is a short, well written introduction to a tremendously important aspect of medicine and is recommended to medical students and clinicians.

UNITED STATES CIVIL DEFENSE. HEALTH SERVICES AND SPECIAL WEAPONS. Federal Civil Defense Administration Publication AG-11-1. Paper. Pp. 260. Price, 60 cents. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

This volume was prepared for the Federal Civil Defense Administration by the Health Resources Office of the National Security Resources Board. Persons with civil-defense health service administrative responsibilities should study "United States Civil Defense" in order to understand the relationship between their service and all other civil-defense services.

A TEXTBOOK OF NEUROANATOMY. By *Albert Kuntz*, Ph.D., M.D., Professor of Anatomy in St. Louis University School of Medicine. Fifth edition, thoroughly revised, with 331 illustrations. Cloth. Pp. 524. Price, $8.00. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1950.

This book has achieved an established position as a completely satisfactory text for use of medical students. In the early chapters embryology and comparative anatomy are taken up to give a background of the nervous system as a whole before the description of microscopic and gross anatomy. Some reference to function of the various pathways and ganglia is correlated and also illustrated by appropriate diagrams. One chapter is devoted to the autonomic nervous system, another explains conditioned responses, and the final chapter contains a laboratory outline for class work. The quality of paper, print and illustrations is excellent. The references have been brought up to date, and the text revised and enlarged. Recommended for use in medical schools, but clinicians would probably prefer for reference purposes a book with more neuromuscular physiology and reference to pathology.

SELECTED QUESTIONS AND ANSWERS. Volume 3. Edited and Compiled under the supervision of *J. F. Hammond*, M.D., Associate Editor, *The Journal of the American Medical Association*. Cloth. Pp. 517. Price, $3.00. American Medical Association, 535 N. Dearborn St., Chicago 10, 1950.

The Questions and Answers section of *The Journal of the American Medical Association* is to many readers one of the most informative and interesting parts of the journal. The present volume is comprised of selected topics from this section which appeared during the years 1943 to 1949. The intriguing aspect of this collection is that only everyday clinical problems are discussed and the information gained from perusal is immediately applicable and not easily available elsewhere. Although the source of the answers is generally anonymous, the editors receive the cooperation of authoritative sources, and when criticism of the answers is indicated it is usually forthcoming in later letters to the editors. This is surely a book most practicing physicians will like to own.

NATURAL CHILDBIRTH: A MANUAL FOR EXPECTANT PARENTS. By *Frederick W. Goodrich, Jr.*, M.D. Cloth. Pp. 176. Price, $2.95. Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, 1950.

This manual is not to be confused with "A Way to Natural Childbirth" which describes a system of exercises as advocated by Dr. Grantly Dick Read. The present text is simply a guide to expectant parents. It explains the normal anatomy and physiology of pregnancy and labor including appropriate anatomical illustrations. Some emphasis is placed on relieving the emotional aspects of fear, especially as related to labor. A chapter is devoted to relaxation technics familiar to physical therapists and as originally described by Jacobson. Another chapter deals with postural exercises and others to improve tone of the skeletal muscles which are used during labor. Recommended as a practical guide devoid of sensationalism.

TAXES AND ECONOMIC INCENTIVES. By *Lewis H. Kimmel*. Cloth. Price, $2.50. Pp. 217. The Brookings Institution, 722 Jackson Place, N. W., Washington 6, D. C., 1950.

The present study is concerned with the taxpayer's reactions and their repercussions in the economic spheres. The object of the book is to appraise the principal taxes now employed and their effects on the economic incentives. The analysis is informative and authoritative.

PHYSICAL MEDICINE ABSTRACTS

The Scope and Future of Physical Medicine and Rehabilitation. Frank H. Krusen.

J. A. M. A. **144**:727 (Oct. 28) 1950.

Because of his qualifications and training, the physiatrist is especially well qualified to collaborate with and to supplement the work of certain other specialists. The equipment of the physiatrist is so complex and his training so extensive that the specialist in these other fields cannot expect to absorb this specialty and incorporate it with his own any more easily than he could absorb and incorporate all the complicated technics of the roentgenologist or the clinical pathologist. There is no more justification for specialists in other fields of medicine to utilize the services of the technical workers in physical medicine without consulting the physiatrist than there would be for their utilizing the services of the technical workers in the departments of roentgenology and the clinical laboratories without consulting the roentgenologist or the clinical pathologist.

It is obvious that the scope of this new medical discipline is enormous and that the future of this specialty is promising. The recent progress has been truly phenomenal, and this field, which is based on the medical applications of physics, should continue its expansion and in the future should attain new heights.

Relation of Maximum Grip Strength to Grip Endurance. W. W. Tuttle; C. D. Janney, and C. W. Thompson.

J. Applied Physiol. **2**:663 (June) 1950.

Strength has been measured by dynamometers of various types since their introduction by Brigham in 1872. In general, strength has been measured either as contraction or breaking strength, expressed as pounds or kilograms. Up to the present time the dynamometers employed provide for measuring maximum strength only. If one wishes to gain a complete picture of strength in man, it seems necessary to record not only maximum strength, but also the tension developed by a group of muscles over a period of time.

A dynamometer for measuring and recording maximum grip strength and strength endurance is described. In order to show the relationship between grip strength and grip strength endurance, data were collected from 200 university men between the ages of 20 and 30 years. The percentage of the maximum grip strength which was maintained for one minute (strength endurance) was correlated with maximum grip strength. The coefficient for the right hand was —0.40 and for the left, —0.41. This suggests that stronger individuals can maintain a smaller proportion of their maximum strength than those with less initial strength. However, a correlation of maximum strength with the strength endurance index gave a coefficient of 0.67 for the right hand, and 0.66 for the left. This indicates that the individuals with the greater maximum strength have a greater strength endurance index.

The Physiologic Analysis of the Psychosomatic Aspect of Peptic Ulcer. Andrew C. Ivy.

South. M. J. **43**:814 (Sept.) 1950.

The aspect of medicine, which is now being termed psychosomatic medicine, had its origin in the field of physiology of the alimentary tract. According to the author in this particular field in the field of psychoanalysis, it is essential physicians employ the classical logic of science and medicine in drawing conclusions. They are no more warranted to draw conclusions in the field of psychosomatic medicine on the basis of the post hoc propter hoc logic or on the basis of faulty physiologic and experimental evidence and systematic analysis than is a person working in any other field.

In considering the subject of psychosomatic medicine, one must apply the same criteria of logic and laws of evidence to this field of medicine that are applied to other fields. According to the present time it cannot be stated unequivocally that any disease is a psychosomatic disease per se. According to analysis of the evidence available at the present time, a tension state is more likely to prove to be an excitatory cause than a basic cause of disease; and if it is ever a basic cause, it operates only on the basis of a constitutional susceptibility of the organ to the disease which affects it.

Rehabilitation of the Crippled Child. Harriet E. Gillette.

J. M. A. Georgia **39**:332 (Aug.) 1950.

A crippled child may be defined as an individual in whom there has been interference with the developmental processes, either before, during, or after birth. Such interference may be in the form of developmental defect, trauma, infection, toxins, degenerative process or other noxious mechanisms, many as yet unclassified. Damage may be in the sensory, motor, or visceral organs and may be so slight as to be merely annoying or so great as to cause total incapacity.

The scope of this paper includes only those children for whom it is good economics to expend a great deal of time, labor and money in order to make them contributing members of society. In setting up a program of rehabilitation our ultimate objective is to enable the individual to be self-sustaining and to lead a full life with both

vocation and avocation. This should be kept in mind at the first and all subsequent examinations, no matter what the age of the child. The immediate objective is to return the patient to a child's life, consistent with his handicap, as soon as possible.

Physical Medicine and Rehabilitation in the Management of Hemiplegia in the Adult. M. K. Newman, and Lewis Cohen.

J. Michigan M. Soc. **49**:915 (Aug.) 1950.

The hemiplegic patient, the forgotten patient in medicine, is capable of unrealized restoration, physically, mentally, socially. Just as other chronic conditions (neoplastic, infectious, and psychiatric) have demonstrated their amenability to rational therapy, the chronic, semi-disabled, hemiplegic patient now finds means for his rehabilitation through an integrated plan of treatment involving medical, surgical, physical, psychological and vocational services.

Rehabilitation of Patient with Hemiplegia. J. F. Nash.

South. Med. & Surg. **112**:295 (Sept.) 1950.

Little of a helpful nature in the management of cases of hemiplegia has been taught in college or hospital. An outline so promising of results as that given by Yamshon will find general welcome, to the profit of many a patient.

In cases in which paralysis has been caused by cerebral hemorrhage, activity must wait until all evidence of bleeding ceases. Patients who have had cerebral embolism or thrombosis can be started on treatment within 48 to 96 hours. Initially, atonicity is usually present. This pseudoflaccid stage later changes to a spastic stage. The muscles on the involved side begin to atrophy immediately as the result of disuse. The involved muscles will respond, by contraction, to electrical stimulation. Electrical stimulation can delay atrophy even in muscles in which peripheral nerves have been severed. To minimize atrophy of disuse, the paretic muscles are electrically stimulated. In the later stages when hypertonicity appears, and with it some degree of voluntary motion, electrical stimulation is no longer indicated.

During the atonic phase, it is important to maintain the range of motion in the joints. Contractures are liable to develop, particularly in older individuals. The commonest site of contracture is the shoulder. Contracture of the ankle in plantar flexion, while common, is more apparent than real. At this stage, motility is maintained by passively moving each joint through its complete range of motion at least once a day.

Occupational therapy procedures, which have the advantage of keeping the patient interested in improvement, are best suited to treatment of the arm. Functional treatment by occupational exercise should be started with the arm at shoulder level. The arm may be supported either on a table or by a sling suspension. Resistance is added as tolerated. With increase in strength, the support may be lowered so that work is done at a lower level, and ultimately the support may be removed. The working position of the unsupported arm may be gradually raised so that it has to be held against gravity.

The Manipulative Treatment of Low Back Pain. Howard J. Schaubel.

J. Michigan M. Soc. **49**:913 (Aug.) 1950.

The principles of the conservative treatment of low backache should include more than rest, heat, braces and massage. An attempt should be made to understand the pathology in the many cases of low backache wherein the x-rays and physical examination throw no light on the cause. All joints, whether deeply or superficially situated in the body, are susceptible to similar kinds of trauma, and will react alike to injury as well as to treatment. Low back pain of indifferent or indeterminate character should be thought of as an interarticular joint and adjacent soft parts injury, and treated according to the accepted methods used in the care of extremity joint sprains, strains and dislocations.

The author has noted no ill effects following the manipulative procedure without anesthesia in over 500 patients. Spinal manipulation is not presented as a cure for all cases of low back pain; it is merely another means of attack for a difficult problem, and is not always sufficient in itself.

Spinal manipulation is a useful adjunct in the treatment of low back pain. A complete history, review of systems, physical examination and roentgen evaluation must be done before manipulation is performed. There are contraindications to manipulation. Where there is demonstrable pathology other than an intervertebral disc injury or muscle spasm, manipulation is neither performed nor advised. Patients with poor cardiac reserve constitute a definite risk to manipulation.

Common Hand Injuries. F. W. Barden.

J. Maine M. A. **41**:267 (July) 1950.

Rehabilitation of hand injuries should begin as soon as the accident has occurred. Proper treatment will help to keep the disability to a minimum. Often, just a chance remark to the injured employee at the time of accident may have a bearing on his future disability and rehabilitation. If splinting is required only that which is absolutely necessary should be used — keeping the rest of the hand mobile. Passive motion is started as soon as it is safe to do so and, as soon as possible, hydrotherapy with whirlpool baths are begun. Exercise of the fingers is encouraged by having the patient work with varying sized rubber balls while receiving the whirlpool. Massage is used considerably. Other exercises also are used to increase finger motion gradually, from gross movement to fine movement. The use of knitting, crocheting, etc., is advocated to facilitate fine finger motion.

Hand injuries are more prevalent than suspected. Hand injuries should be given the same "high lighting" in an industrial program as are injuries to the eye. Selective placement of employees will decrease hand accidents. Proper immediate treatment of all hand injuries is essential. (Try to give treatment during the "golden period" which is six hours post trauma.) All wounds to the hand should be considered contaminated at time of injury. Rehabilitation of hand injuries should begin as soon as the accident has occurred. Attempt to get the injured employee back on the job as soon as possible.

Pain in the Neck and Shoulder. Harold N. Neu.

Nebraska M. J. 35:312 (Oct.) 1950.

The problem of neck and shoulder pain commands the interest of the general practitioner, the internist, the orthopedist, the radiologist, the neurologist and many others in the practice of medicine. It is not the province of the chiropractor as often is popularly thought.

It is also recognized that a stiffening of the shoulder and painful shoulder occurs quite frequently after myocardial infarction. It is believed that the pain associated with the infarction sets off a series of reflexes which cause considerable vasospasm in the tissues about the shoulder joint. This in turn creates a fibrositic reaction with the resulting pain and limitation of motion. The author doubts that all of these cases of the so-called post-infarction syndromes are actually that. It may be the result of placing a patient with a coronary thrombosis in bed for three to six weeks in relative immobility without activity of his shoulders. There is little reason why the average patient with coronary occlusion should not go through a daily set of shoulder exercises to maintain the normal activity and range of motion of the shoulder. This same type of problem applies also to the management of the hemiplegic patient who is allowed to remain quiet without immediate attention to physical therapy. Dinken has emphasized how important it is that the education and rehabilitation of the hemiplegic patient be instituted as rapidly as possible.

Electrophrenic Respiration.

Comment Lancet 6633:473 (Oct. 14) 1950.

A vast public still is fascinated by the ingenious "iron lung" devised in 1929 by Drinker and Shaw for "prolonged administration of artificial respiration." This apparatus is alternately the hope and the despair of the clinician called on to treat bulbar or bulbospinal poliomyelitis with respiratory failure. He can rarely prophesy whether the treatment will be: (1) a brilliant success, tiding the patient over a difficult period until use of the respiratory muscles is restored to him; (2) a comparative failure with a hopelessly paralyzed patient depending on the respirator for continued existence; or (3) a complete failure, giving little or no relief because of an obstructed airway or concomitant paralysis of the respiratory center. Many of these cases are complicated by pharyngeal or laryngeal paralysis, and the consequent pooling of mucus leads to obstruction of the respiratory passages. Under these conditions the violent inspirations induced by the respirator give rise to a negative pressure in the bronchioles and alveoli, into which plasma and red cells are sucked producing hemorrhagic pulmonary edema. To ward off this danger respirator treatment may be combined with postural drainage and suction.

A new and apparently effective method of meeting this difficulty is now described by a Boston team under the leadership of Sarnoff. Patients with irregular, shallow, spontaneous respiration who failed to adapt their breathing to the respirator's rhythm have been submitted to this stimulation for periods varying from eight hours to several days. It seems that, even after a few hours, spontaneous respiration may be greatly improved, but in the worst cases stimulation may have to be continued for some time before the respiratory center has sufficiently recovered.

Inhibition of Knee Jerk From Tendon Spindles of Crureus. G. P. McCough; I. D. Deering, and W. B. Stewart.

J. Neurophysiol. 13:343 (Sept.) 1950.

Autogenous inhibition of muscle is usually attributed to tendon spindles. The evidence certainly points in that direction, yet it is far from constituting proof. It is the purpose of this paper to present data which indicate that such inhibition is due to activity of receptors limited to the region of musculotendinous junctions.

The knee jerk of decerebrate cats was inhibited by electrical stimulation of the distal portion of crureus muscle. The receptors concerned were demonstrated to be confined to the region containing musculo-tendinous junctions. The tendon spindle of Golgi is the only type of end-organ limited to this region of the muscle. Hence, it is concluded that autogenous inhibition of muscle is due to this type of receptor. The form of the inhibition curve is modified by the inevitable involvement of other end-organs, notably of muscle spindles. An entire functional muscle group may be inhibited from tendon spindles in one member of that group.

Measurement of Pathological Pain in Distinction to Experimental Pain. Arthur S. Keats; Henry K. Beecher, and Frederick C. Mosteller.

J. Applied Physiol. 3:35 (July) 1950.

There are large variations in the intensity, duration and objective manifestations of clinical pain. The frequent failure of the order of pain to correlate with the pathological process has frustrated many attempts to study clinical pain. Distrust has arisen concerning the reliability of the subjective data of patients in pain from disease and resort has been made to the study of pain experimentally produced and measured.

It seems certain that pain, as it is usually produced experimentally, does not reproduce the pain of disease or trauma; but it is not so certain to what extent conclusions from experimentally produced pain apply to naturally occurring pain. In practice this uncertainty is avoided by the use of clinical pain.

Heretofore the subjectivity, the variation and the lack of measurable units have often deterred observers from the use of clinical pain for pharmacological investigation, in preference to experimentally produced pain. In presenting this method for the determination of analgesic potency it has been demonstrated that the subjectivity of the data is no serious limitation when adequate controls are used, both in the experimental design and in the collection of data. The individual variation in clinical pain is often larger, but not different in type from that found in most experimentation; this variation can be measured and accounted for. Pathological pain can be measured and expressed quantitatively in terms of its relief by an analgesic. The method presented can be used as a model for the collection and precise measurement of subjective data of many types, especially useful in physiological experimentation.

Rheumatoid Spondylitis (Strumpell-Marie Arthritis): Orthopedic Management. Theodore A. Potter.

Am. Pract. 1:1129 (Nov.) 1950.

Pain in the low-back and sacroiliac areas causes lumbar muscle spasm so that the normal lordosis is obliterated. The flat low back is an early sign of spondylitis.

The cervical spine may become flexed or extended, depending on the patient's posture. If he has been active, that is, on his feet during the flexion phase of the dorsal spine, he will gradually compensate by hyperextending his cervical spine. If, on the other hand, he remains in a chair or bed, propped up with pillows, the head will gradually drop forward and many times become ankylosed there. Most cases acquire rotation to one side or another, usually a left-tilted head in a right-handed individual. In one such case the chin and left cheek rested on the chest wall and was rigidly ankylosed there.

Hips and shoulders are commonly involved and may become ankylosed. Faulty body mechanics is the predisposing factor in the production of these joint changes. Added stress and strain seems to be the inciting cause so that they break down, wear out and lose motion.

Picture a patient with a rigid, flexed spine. If he stays this way he cannot see where he's going, so to compensate for lost spinal motion he flexes hips and knees in walking and standing. When this attitude is maintained for a period of years, flexion deformity of hips and knees takes place. No joint improperly aligned will long bear such usage, and it will break down. Hips develop deformities in flexion and adduction, the former due to bad posture and spasm of the iliopsoas, the latter due to adductor spasm, and later contraction. The shoulders become fixed to the chest and lose the range of motion in abduction and external rotation. Upper spinal muscle spasm clamps the arms to the sides, contractures later set in and the anterior muscles, particularly the pectorals, become shortened; all this then leads also to restricted shoulder motion. We have seen several cases of complete rigidity from toe tips to eyeballs.

The treatment of rheumatoid spondylitis is almost wholly an orthopedic problem. Its aim is two-fold: (1) arresting the inflammation; and (2) prevention of spinal and chest deformity, and subsequent lower extremity and shoulder deformities.

Included in the treatment are hot fomentations to the spine and hips given three times daily. Moist heat quiets the spasm better than dry heat. Lying postural exercises and gentle back massage are given two to three times daily. Initial exercises are performed to increase chest expansion, gain control of abdominal muscles and strengthen spinal extensors.

Spinal braces have been discarded by the author, since they do not do the job of protection or correction adequately.

In the older patients with demonstrable calcification by roentgen ray and what appears to be clinical rigidity with flexion deformity, the same serial jacket program is carried out. In spite of apparent ankylosis there always are one or more areas that are slightly movable, and through these, corrections can be made. The cervicodorsal, dorsolumbar junctions are the two usual sites where slow stretching can take place with the repeated corrective jackets. Head traction and a special adjustable chin post attached to the jackets help to correct and maintain flexed cervical spines.

Treatment of Congenital Clubfeet with Wedging Casts. G. M. Hart.

J. A. M. A. 144:790 (Oct. 28) 1950.

According to Hart, congenital clubfoot occurs about once in each 1,000 births. A hereditary background is ascertained in 5 to 45 per cent of the cases. There are four deformities present in congenital clubfoot: (1) adduction of the forefoot, (2) inversion of the hind foot, (3) equinus and (4) tibial torsion. The author states that most children with a congenital clubfoot deformity treated within the first six months of life can obtain a functionally normal foot by nonoperative treatment. Plaster casts are applied and wedged to correct the deformity, the forefoot adduction and inversion of the heel being corrected first and the equinus element last. The feet are then held in retention casts for eight to 12 weeks. After removal of the casts follow-up treatment consisting of stretching exercises and clubfoot shoes is necessary. This method should be thoroughly applied before surgical measures are undertaken.

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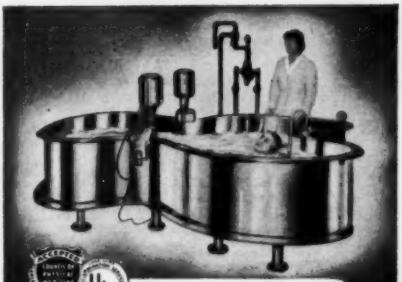

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PHYSICAL MEDICINE **

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Hospitals, 42 Assistant Residencies and Residencies, 55

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	Asst. Res. & Residencies Offered [3]	Beginning of Service (1950)	Beginning Stipend (Month)
United States Army							
Letterman General Hospital★	San Francisco	A. E. White	21,861	185,112	2	1/1, 7/1	n
†Fitzsimons General Hospital★	Denver	H. B. Luscombe	21,090	251,585	4	.....	n
Army Medical Center★	Washington, D. C.	E. M. Smith	8,676	134,137	6	7/1	n
Veterans Administration							
†Veterans Admin. Hospital [1]	Ft. Logan, Colo.	F. J. Fricke	4,610	58,879	1	.....	n
Veterans Admin. Hospital	Chamblee, Ga.	G. D. Williams	4,923	39,181	1	7/1	n
Veterans Admin. Hospital	Hines, Ill.	L. B. Newman	20,052	472,950	2	1/1, 7/1	n
Veterans Admin. Hospital	New Orleans	S. Winokur	1,107	40,815	1	7/1	n
Veterans Admin. Hospital [1]	Framingham, Mass.	F. Friedland	9,000	24,000	2	7/1	n
Veterans Admin. Hospital [1]	Jefferson Bks., Mo.	S. Mead	4,046	53,920	2	7/1	n
†Veterans Admin. Hospital [1]	New York City	K. Harpuder	12,613	279,817	3	1/1, 7/1	n
Veterans Admin. Hospital [1]	Cleveland	H. T. Zankel	2,452	105,000	2	7/1	n
†Veterans Admin. Hospital	Aspinwall, Pa.	S. Machover	1,993	62,792	1	7/1	n
†Veterans Admin. Hospital	Portland, Ore.	E. W. Fowlks	4,395	96,766	1	1/1, 7/1	n
Nonfederal							
Los Angeles County Hospital★ [1]	Los Angeles	O. L. Huddleston	.....	133,694	1	Varies	$165.00
White Memorial Hospital★	Los Angeles	F. B. Moor	33,606	.....	....	.....	120.00
Stanford University Hospitals★ [1]	San Francisco	W. H. Northway	.....	6,833	....	7/1	50.00
University of Colorado Medical Center Colorado General Hospital★ [1]	Denver	H. L. Dinken	2,322	25,088	1	7/1	75.00
†Emory University Hospital★	Emory Univ., Ga.	R. L. Bennett	9,848	20,266	1	7/1	50.00
†Georgia Warm Springs Foundation	Warm Springs, Ga.	.....	889	1,108	2	.....	.....
Cook County Hospital★ [1]	Chicago	D. Kobak	3,357	33,282	....	1/1, 7/1	.....
Michael Reese Hospital★ [1]	Chicago	C. O. Molander	1,607	19,443	1	Varies	25.00
Northwestern University Medical School	Chicago	.....	13,284	34,813	....	.....	.....
University of Kansas Medical Center★	Kansas City, Kan.	D. L. Rose	11,684	31,838	1	7/1	100.00
†Massachusettts General Hospital★	Boston	.....	.....	.....	....	.....	.....
University of Minnesota Hospitals★ [1]	Minneapolis	M. Knapp	15,391	21,885	4	.....	105.00
Mayo Foundation	Rochester, Minn.	F. H. Krusen	.....	.....	9	Varies	92.50
Barnes Hospital★	St. Louis	.....	820	10,951	....	7/1	25.00
†Bellevue Hospital, Div. III— New York University★	New York City	.....	.....	.....	....	.....	.....
Goldwater Memorial Hospital★ [1]	New York City	.....	2,799	124,357	....	.....	.....
Hospital for Joint Diseases★ [1]	New York City	J. Weiss	76,070	93,036	1	7/1	40.00
Hospital for Special Surgery	New York City	K. G. Hansson	.....	41,111	....	.....	.....
Montefiore Hosp., for Chronic Diseases★ [1]	New York City	K. Harpuder	.....	.....	....	.....	.....
Mount Sinai Hospital★	New York City	W. Bierman	.....	.....	....	7/1	50.00
New York City Hospital★ [1]	New York City	F. K. Safford, Jr.	955	26,418	....	.....	.....
†Presbyterian Hospital ★ [1]	New York City	W. B. Snow	70,405	191,021	2	1/1	41.66
St. Luke's Hospital★	New York City	R. Muller	1,202	126,904	1	7/1	50.00
†Rehabilitation Hospital [1]	W. Haverstraw, N. Y.	M. Hoberman	322	291,115	1	.....	200.00
Cleveland Clinic Hospital [1]	Cleveland	S. G. Gamble	17,885	17,884	1	7/1	135.00
Hospital of the Univ. of Pennsylvania★ [1]	Philadelphia	G. M. Piersol	1,396	15,575	1	Varies	100.00
Philadelphia General Hospital★ [1]	Philadelphia	.....	3,073	21,769	....	.....	.....
Medical College of Virginia, Hosp. Div.★ [1]	Richmond, Va.	F. A. Hellebrandt	3,787	34,009	....	.....	.....
State of Wisconsin General Hospital★ [1]	Madison, Wis.	H. D. Bouman	3,783	45,840	....	.....	.....

The star (★) indicates hospitals approved for training interns.
The dagger (†) indicates temporary approval.
[1] Residencies open to women.
[3] Includes Fellowships.
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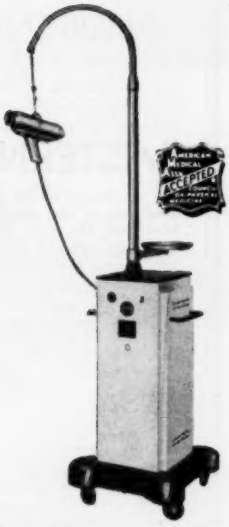

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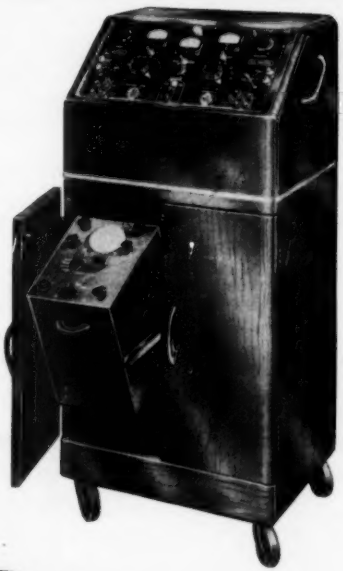

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MEETINGS OF INTEREST TO THOSE IN THE FIELD OF PHYSICAL MEDICINE

In this column will be published information about meetings of interest to those in the field of physical medicine. New data should be sent promptly to the office of the ARCHIVES, 30 North Michigan Avenue, Chicago 2, Illinois.

American Congress of Physical Medicine. — 29th Annual Session, Shirley-Savoy Hotel, Denver, Colo., Sept. 4, 5, 6, 7, 8, 1951. Walter J. Zeiter, M.D., Chairman, Convention Committee, 30 North Michigan Ave., Chicago 2.

Eastern Section, American Congress of Physical Medicine. — Philadelphia, Saturday, April 28, 1951. Albert A. Martucci, M.D., Secretary, Abington Memorial Hospital, Abington, Pa. *See announcement, elsewhere this issue.*

Section on Physical Medicine and Rehabilitation of the American Medical Association. — Wednesday, Thursday and Friday morning of the A.M.A. meeting (June 11-15, 1951) in Atlantic City. Secretary, Walter J. Zeiter, M.D., Cleveland Clinic Foundation, 2020 E. 93rd Street, Cleveland 6, Ohio.

Chicago Society of Physical Medicine and Rehabilitation. — Meetings, fourth Wednesday, January, through May, 1951. Next meeting Wednesday, February 28, Cook County Hospital, 1835 West Harrison St., Chicago. Arthur A. Rodriquez, M.D., Secretary, 30 North Michigan Ave., Chicago 2.

New Jersey Society of Physical Medicine. — Meetings, fourth Wednesday. James C. Hanrahan, M.D., Secretary, 678 N. Broad St., Elizabeth 3, N. J.

New York Society of Physical Medicine. — Meetings, first Wednesday. Madge C. L. McGuinness, M.D., Secretary, 48 E. 62nd St., New York 21, N. Y.

Pennsylvania Academy of Physical Medicine. — Meetings, third Thursday. Charles Furey, Jr., M.D., Secretary, 2501 S. Cleveland Avenue, Philadelphia 45, Pa.

Latin-American Congress of Physical Medicine. — Third Congress of physicians of the Latin countries and the United States interested in Physical Medicine, Ciudad Trujillo, Dominican Republic, March 21-26, 1951. Secretary, Madge C. L. McGuinness, M.D., 48 E. 62nd St., New York 21, N. Y. H. A. Sonn, program chairman, Room 600, 110 East 23rd St., New York 10, N. Y.

American Physical Therapy Association. — Glenwood Springs, Colo., Hotel Colorado, June 17-22, 1951. Mildred Elson, Executive Director, 1790 Broadway, New York 19, N. Y.

International Polio Conference. — Second International Polio Conference, Sept. 2 to 7, 1951, Copenhagen. *See announcement elsewhere this issue.*

World Confederation for Physical Therapy. — Sept. 7 and 8, 1951, Copenhagen. Further information may be obtained from Miss M. J. Neilson, Convener and Secretary, Provisional Committee, World Confederation for Physical Therapy, Tavistock House North, Tavistock Square, London W. C. 1, England.

American Occupational Therapy Association. — Annual Convention, Sept. 8 to 15, Durham, N. H., Wentworth-by-the-Sea Hotel. Co-chairmen, Eleanora Chernewski, VA Hospital, Togus, Maine, and Margaret L. Blodgett, U. S. Marine Hospital, Brighton, Mass.

Fifth World Congress of the International Society for the Welfare of Cripples. — Stockholm, Sweden, Sept. 10-14, 1951, Mr. Karl Montan, Secretary, Svenska Vanforevandens Centralkommittee, Jutas Backe 1, Stockholm C, Sweden, or office of the International Society, 54 East 64th Street, New York 21, N. Y.

The National Society for Crippled Children and Adults, Inc. — 1951 annual convention, Palmer House, Chicago, October 3, 4, 5 and 6, 1951. Lawrence J. Linck, Executive Director, 11 So. La Salle St., Chicago 3.

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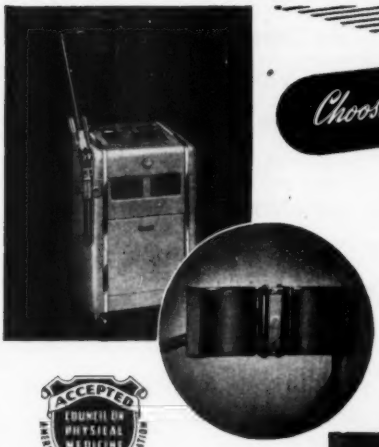

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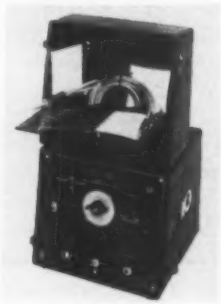

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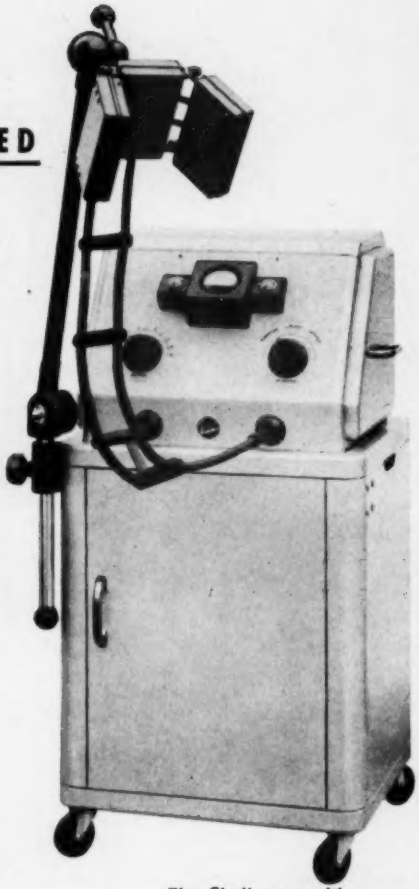

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